December 12, 2022

Robert Zuber
Colorado Division of Reclamation, Mining, and Safety
1313 Sherman St, Rm 215
Denver, CO 80203
(303) 866-3567

Delivered Via Email
RE: Delta Paving Gravel Pit, M-1998-105
AM-01 Application Adequacy 3 Response

Mr. Zuber:

Please accept this letter on behalf of Grand Junction Pipe & Supply Co. dba Elam Construction, Inc. as the response to the third adequacy letter from your office dated November 21, 2022 regarding the Delta Paving Gravel Pit, File No. M-1998-105. Responses are also provided for the Groundwater Monitoring Plan and Geotechnical adequacy comments that were received by the Division. The outstanding items are addressed below:

1. Third Adequacy Review

Comments

6.4.7 Exhibit G – Water Information

13) In the Floodplain section, text should be added to explain how the northern banks of the Phase 3 area will be protected during flooding.

- *i) F-1 Reclamation Plan references the Mile High Flood District (MHFD) document "Technical Review Guidelines for Gravel Mining & Water Storage Activities Within or Adjacent to 100-Year Floodplains." Table 2.1 of that document (page 27) provides minimum top width values for riverbank berms. It appears that Phase 3 of the proposed mining plan for the Delta Paving Gravel Pit permit, with a side channel spillway included in the design but no riverbank protection, is in the category that requires a 300-foot minimum top width. However, the final configuration of the Phase 3 pit (per maps submitted with AM-01) is approximately 100 feet from the southern bank of the Gunnison River.* ***The applicant must revise the Mining and Reclamation Plans to meet the 300-foot setback, or explain why this criteria in the MHFD guidelines is not applicable.***
- *ii)* ***The details on F-1 Reclamation Plan still include the term "high water thalweg." This should be revised.***

While the applicant interprets the MHFD to require a 100-foot setback, the mining plan has been adjusted to accommodate the 300-foot setback as requested. Please refer to the revised Map C-2 and F-1 with the appropriate changes. Mining will not encroach within the 300-foot setback to the

river unless further analysis through a technical revision is supplied to the Division. As such, the 300-foot setback has been marked in the revised maps, but the full mining plan to 100 feet within the river with a flood protection structure is still shown.

Map F-1 has been revised to remove all use of the term 'high water thalweg'.

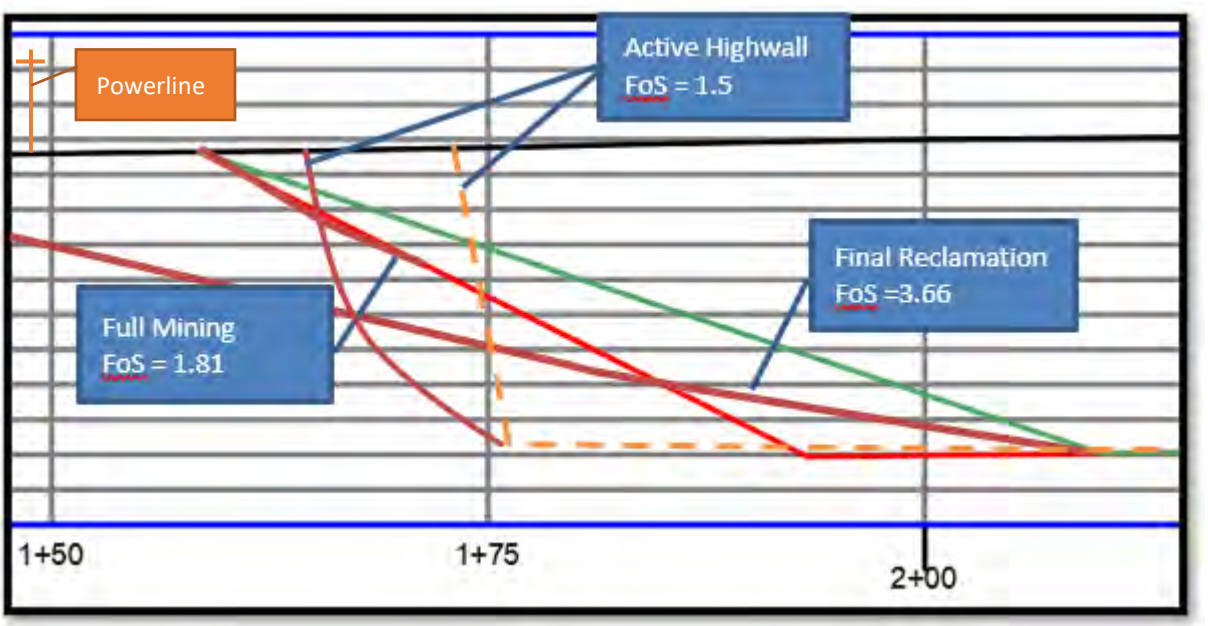
6.5 Geotechnical Stability Exhibit

1) *The Applicant's response to Item #9 from the September 2, 2022 memo was incomplete. The response ended with "If any…". Please provide the complete text for the response for Item #9.*

Slope stability is monitored during operations by regular visual inspections of the highwall by operation personnel. Disturbance boundaries are clearly marked in advance of mining to prevent over excavation. Berms, constructed well in ahead of mining nearing them, act as an additional perimeter delineation. Periodic site surveys via drone are used to confirm slopes. (Note, the "if any.." was intended to be deleted)

2) *On Page GS-1, the Applicant states a standard slope in Phase 4 was analyzed for stability as it is the closest to offsite structures like fences and the state highway. Please revise the stability analysis for the worst case scenario, which appears to be the 12.5 feet offset from the overhead powerlines north of Phase 3.*

As can be seen on Figure GS-2, there is no failure circle that extends beyond the final reclamation crest of any mining Phase. Therefore, any structure that exists beyond said excavation crest will be safe from slope failure. A copy of Figure GS-2 is shown below with the powerline location included for clarity.



3) *The required offset from the powerlines north of Phase 3 differs between the table on Map C-2 (15 feet) and the notation on the map (12.5 feet). Please explain this discrepancy and update Map C-2 accordingly.*

Map C-2 has been corrected.

4) *Please update Map C-2 to indicate the notated offset for all structures.*

The table on Map C-2 has been updated.

5) *The Applicant states the native alluvial material is best classified as sand and gravel with mixed grain size and used an internal angle of friction of 45 degrees with no cohesion. Since soil property lab data is not available for the site, the Division recommends the Applicant uses the Division approved friction angle of 37 degrees with no cohesion for sand and gravel.*

Shown below is the source table from the SME Reference Handbook that material properties for the sand and gravel is sourced:

TABLE 2.5 Unit weight, friction angle, and cohesion for soils and rocks

Description		Unit Weight (Saturated/dry)		Friction Angle	Cohesion	
Type	Material	(lb/ft^3)	(kN/m^3)	(degrees)	(lb/ft^2)	(kPa)
Cohesionless						
Sand	Loose sand, uniform grain size	118/90	19/14	28–34*		
	Dense sand, uniform grain size	130/109	21/17	32–40*		
	Loose sand, mixed grain size	124/99	20/16	34–40*		
	Dense sand, mixed grain size	135/116	21/18	38–46*		
Gravel	Gravel, uniform grain size	140/130	22/20	34–37*		
	Sand and gravel, mixed grain size	120/110	19/17	48–45*		
Blasted/ broken rock	Basalt	140/110	22/17	40–50*		
	Chalk	80/62	13/10	30–40*		
	Granite	125/110	20/17	45–50*		
	Limestone	120/100	19/16	35–40*		
	Sandstone	110/80	17/13	35–45*		
	Shale	125/100	20/16	30–35*		
Cohesive						
Clay	Soft bentonite	80/30	13/6	7–13	200–400	10–20
	Very soft organic clay	90/40	14/6	12–16	200–600	10–30
	Soft, slightly organic clay	100/60	16/10	22–27	400–1,000	20–50
	Soft glacial clay	110/76	17/12	27–32	600–1,500	30–70
	Stiff glacial clay	130/105	20/17	30–32	1,500–3,000	70–150
	Glacial till, mixed grain size	145/130	23/20	32–35	3,000–5,000	150–250
Rock	Hard igneous rocks—granite, basalt, porphyry	160 to 190†	25 to 30	35–45	720,000–1,150,000	35,000–55,000
	Metamorphic rocks—quartzite, gneiss, slate	160 to 180	25 to 28	30–40	400,000–800,000	20,000–40,000
	Hard sedimentary rocks—limestone, dolomite, sandstone	150 to 180	23 to 28	35–45	200,000–600,000	10,000–30,000
	Soft sedimentary rock—sandstone, coal, chalk, shale	110 to 150	17 to 23	25–35	20,000–400,000	1,000–20,000

* Higher friction angles in cohesionless materials occur at low confining or normal stresses.
† For intact rock, the density of the material does not vary significantly between saturated and dry states with the exception of some materials such as porous sandstones.
Source: Houk and Bray 1977 *(reprinted with permission from the Institution of Mining & Metallurgy)*

The bottom value of each range is used in the GALENA model: 110pcf, 45°.

6) *The Applicant states a layer of overburden/topsoil lies atop of the sand and gravel and used an internal angle of friction of 32 degrees with modest cohesion (1320 pcf). Since soil property lab data is not available for the site, the Division recommends the Applicant uses the Division approved friction angle of 28 degrees with 150 pcf effective cohesion for the overburden material.*

The material values for the overburden layer are shown below. The saturated cohesion (460 psf) is used in the GALENA model, which has been updated to correct for the previous error.

Table 3.1 Average Effective Shear Strength of Compacted Soils.

UNIFIED CLASSIFICATION	SOIL TYPE	PROCTOR MAXIMUM DRY DENSITY pcf	PROCTOR COMPACTION OPTIMUM MOISTURE CONTENT %	AS COMPACTED COHESION c_o tsf	SATURATED COHESION c_{sat} tsf	FRICTION ANGLE $\bar{\phi}$ deg
GW	well graded clean gravels, gravel-sand mixture	>119	<13.3	*	*	>38
GP	poorly graded clean gravels, gravel sand mixture	>110	<12.4	*	*	>37
GM	silty gravels, poorly graded gravel-sand-silt	>114	<14.5	*	*	>34
GC	clayey gravels, poorly graded gravel-sand-clay	>115	<14.7	*	*	>31
SW	well graded clean sands, gravelly sands	119±5	13.3±2.5	0.41±0.04	*	38±1
SP	poorly graded clean sands, sand-gravel mixture	110±2	12.4±1.0	0.24±0.06	*	37±1
SM	silty sands, poorly graded sand-silt mixture	114±1	14.5±0.4	0.53±0.06	0.21±0.07	34±1
SM-SC	sand-silt-clay with slightly plastic fines	119±1	12.8±0.5	0.21±0.07	0.15±0.06	33±3
SC	clayey sands, poorly graded sand-clay mixture	115±1	14.7±0.4	0.78±0.16	0.12±0.06	31±3
ML	inorganic silts and clayed silts	103±1	19.2±0.7	0.70±0.10	0.09±*	32±2
ML-CL	mixtures of inorganic silts and clays	109±2	16.8±0.7	0.66±0.18	0.23±*	32±2
CL	inorganic clays of low to medium plasticity	108±1	17.3±3	0.91±0.11	0.14±0.02	28±2
OL	organic silts and silty clays of low plasticity	*	*	*	*	*
MH	inorganic clayey silts, elastic silts	82±4	36.3±3.2	0.76±0.31	0.21±0.09	25±3
CH	inorganic clays of high plasticity	94±2	25.5±1.2	1.07±0.35	0.12±0.06	19±5
OH	organic clays and silty clays	*	*	*	*	*

*denotes insufficient data, > is greater than, < is less than
(After Bureau of Reclamation, 1973; 1 pcf=157.1 N/m³, 1 tsf=95.8 kPa)

7) *The Applicant utilized a third soil type, Loose sand, with an internal friction of angle of 32 degrees with no cohesion in the Galena models. Please provide the source of the material properties for the soil type.*

This soil type has been removed from the GALENA models. Only two soil types are used in the updated model.

8) *Please provide the cross-section model output files from Galena for three modeled slopes: final mining (2H:1V), final reclamation (3H:1V) and active highwall (near vertical) slopes.*

See the attached revised geotechnical stability exhibit for GALENA output files.

9) *On Page GS-4, Table GS-1 Factors of Safety for Slope Stability indicates the required offset distance from the property line for the full mining slope (70 feet), final reclamation (80 feet) and active highwall (75 feet). The minimum setback table on Map C-2 indicates a minimum offset of 50 feet. Please explain this discrepancy and update the stability analysis and/or the Map C-2 table accordingly.*

The table on Map C-2 notes the minimum setbacks that apply for the mining operation for each type of structure. Table GS-1 lists how close the GALENA model shows each failure circle. Any distances in Table GS-1 being greater than or equal to a setbacks shows that the setbacks are sufficient to ensure protection of the structures. For example, the setback to powerlines is 12.5-ft; the Active Highwall model's FoS = 1.5 circle is 19-ft away from the powerline, thus showing that even if the Active Highwall fails at FoS = 1.5 it will not damage the powerline.

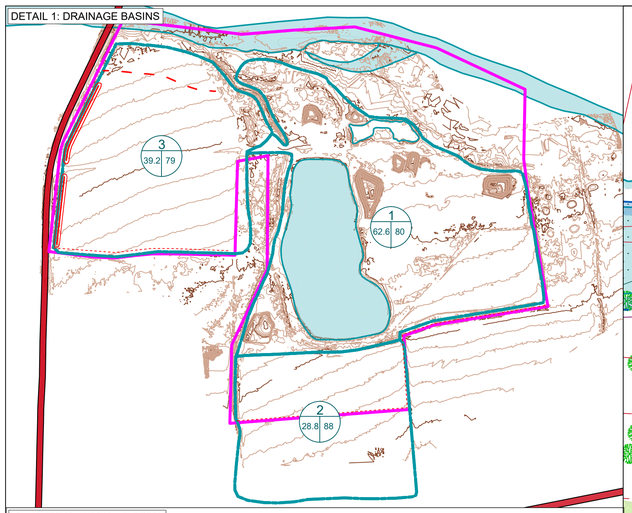
Regards,

Ben Langenfeld, P.E
Lewicki & Associates

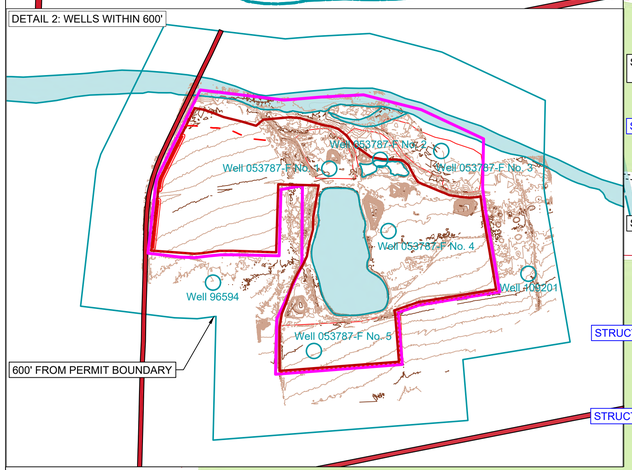
Attachments

- Revised 112c Amendment Application Portions:
  - Exhibit C
    - Map C-2
  - Exhibit F
    - Map F-1
  - Rule 6.5 Geotechnical Stability Exhibit

DETAIL 1: DRAINAGE BASINS



DETAIL 2: WELLS WITHIN 600'



STRUCTURE SETBACKS		
NUMBER	STRUCTURE	MINIMUM SETBACK FROM MINING (ft)
1	FENCES	50
2	HIGHWAY CO-65	90
3	GRAVEL DRIVEWAY	150
4	GRAVEL DRIVEWAY	150
5	OVERHEAD ELECTRIC LINES AND POLES	12.5
6	RELIEF DITCH	15
7	BROAD AX DITCH	15
8	FEED LOTS & ASSOCIATED BUILDINGS	165
9	RESIDENCE, AGRICULTURE RELATED BUILDINGS, AND GRAVEL DRIVEWAY	125

STRUCTURE 5
MIN. 12.5' FROM POWERLINES
STRUCTURE 6
MIN. 300' SETBACK FROM RIVER
CDRMS TECHNICAL REVISION REQUIRED TO MINE CLOSE THAN 300' SETBACK
RELIEF DITCH
GUNNISON RIVER
STRUCTURE 4
MIN. 15' FROM IRRIGATION EASEMENT
TOTAL DISTURBED AREA 110.6 acres
PIT DEWATERING TRENCH
STRUCTURE 7
BROAD AX DITCH
OVERBURDEN STOCKPILE AREA
PHASE 3
GENERAL MINING DIRECTION
10' MIN. MAINTAINED ON EACH SIDE OF ACCESS ROAD
SCREENING BERMS MIN. 8 FT TALL
CULVERT
SCALE AND SCALE HOUSE
FEMA FLOODWAY BOUNDARY (NO MINING WITHIN THIS ZONE)
STRUCTURE 3
STOCKPILING AREA
MIN. 15' FROM IRRIGATION EASEMENT
MINING SLOPES 2H:1V
NPDES DISCHARGE PT
SITE ACCESS
PRODUCT STOCKPILES (TYP.)
FEED LOTS
PIT DEWATERING TRENCH
PHASE 4
PIT DEWATERING PUMP LOCATION (TYP.) WATER PUMPED TO SETTLING POND SEE DETAIL 3
GENERAL MINING DIRECTION
STRUCTURE 2
RECLAIMED LAKE USED AS SETTLING POND
1 2 3
PHASE 1
CULVERT
STRUCTURE 1
MINING SLOPE 3H:1V ADJACENT TO LAKE
CULVERT
CO-65
CULVERT
STRUCTURE 9
Well 96594
MIN. 30' FROM EXISTING POND
Well 109201
SECONDARY PROPERTY ACCESS NOT USED FOR MINING TRAFFIC
RELIEF DITCH
CULVERT
TOPSOIL STOCKPILE AREA
STRUCTURE 8
MIN. 15' FROM IRRIGATION EASEMENT
CULVERT
MIN. 30' FROM ADJACENT PROPERTIES
HMA PLANT AREA (WHEN PLANT IS PRESENT
PERMIT AND AFFECTED AREA: 144.9 acres
PHASE 2
MINING SLOPES 2H:1V

C-2 Mining Plan

Delta Paving Gravel Pit

DRMS Permit Number: M-1998-105 — **Elam Construction**

Mine Entry Location:	Latitude: 38.76815	Longitude: -107.99419
State: CO	County: Delta	Nearest Town: Delta
Section: 10	Township: 15S	Range: 95W PM: 6th
Major Watershed:	Gunnison River	MSHA ID: N/A

Map Scale: 1"= 200'

0 100 200

Map Georeferencing Information: **Datum:** NAD83 **Projection:** CO CENTRAL

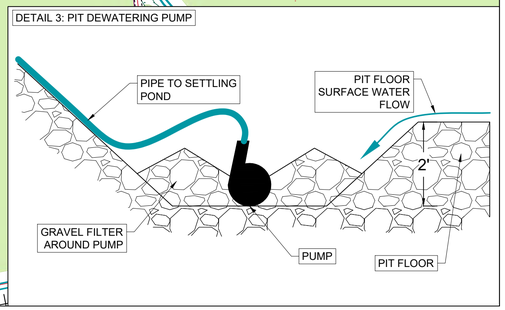
Survey Source: Drone	**Drawn by:** SAC	Date: 09/13/22
Imagery Source: Google	**Checked by:** BEL	Date: 09/13/22
Survey Date: 11/18/21	**Approved by:** BEL	Date: 09/13/22
Imagery Date: ----		

File Name: Delta Paving 221116

Lewicki & Associates
3375 West Powers Circle
Littleton, CO USA 80123
(303)-346-5196
info@lewicki.biz

COLORADO LICENSED BRIAN E. LEWICKI 47251 PROFESSIONAL ENGINEER 09/08/22

DETAIL 3: PIT DEWATERING PUMP



LEGEND

BOUNDARIES
- State or territorial
- County or equivalent
- Incorporated city or equivalent

BUILDINGS AND RELATED STRUCTURES
- Building
- Well (other than water) — Well Name
- Fence

LAND SURVEYS
- Public Land Survey System
- Range or Township line — Range or Township labels: R1E T2N
- Section line — Section numbers: 1-36
- Mining claim or property boundary

ROADS AND RELATED FEATURES
- Highway
- Light duty road, paved
- Light duty road, gravel
- Unimproved road
- Gate on road
- Railroad

RIVERS, LAKES, SHORELINES, AND CANALS
- Perennial stream/ditch
- Perennial river
- Perennial lake/pond
- Waterwell — Well Name
- Drainage Directions
- Drainage Basin
- Floodplain & Floodway

DRAINAGE BASINS

Basin 1 (62.6 acres, 80 Composite Curve Number) — Basin Destination 1

VEGETATION
- Agricultural Fields
- Rangeland
- Woodlands & Trees
- Wetlands (NWI 1983)

TRANSMISSION LINES AND PIPELINES
- Power transmission line; pole; tower
- Power transmission line, buried
- Telephone/data line, above ground
- Telephone/data line, buried
- Pipeline (non-water), above ground
- Pipeline (non-water), buried

MINING FEATURES
- DRMS Permit Boundary
- Fixed Structures
- Mobile Structures
- Mining Phases
- Berm/windrow
- Disturbed Area

BASELINE CONTOURS
- Index — Approximate of indefinite
- Intermediate — Approximate of indefinite
- Supplementary

POST-MINING CONTOURS
- Index — Approximate of indefinite
- Intermediate — Approximate of indefinite
- Dump

MIN. 12.5' FROM POWERLINES

MIN. 300' SETBACK FROM RIVER
SEE MAP C-2

INFLOW/OUTFLOW STRUCTURE
SEE DETAILS 1 & 2

RELIEF DITCH

GUNNISON RIVER

BROAD AX DITCH

MIN. 15' FROM DITCH

RECLAIMED LAKE
0.97 acres

3
POST MINE LAND USE:
GROUNDWATER LAKE
10.6 acres (accounts for 300' setback)

BERMS FLATTENED

TOTAL DISTURBED AREA
110.6 acres

10' MAINTAINED ON EACH
SIDE OF ACCESS ROAD

RECLAIMED LAKE
14.6 acres

CULVERT

FEED LOTS

SITE ACCESS

3
POST MINE LAND USE:
GROUNDWATER LAKE
13.9 acres

MIN. 30' FROM
ADJACENT PROPERTIES

3
39.2 | 79

1
TOTAL NEW GROUNDWATER EXPOSURE:
56.8 acres
TOTAL GROUNDWATER EXPOSURE:
72.4 acres

1
POST MINE LAND USE:
GROUNDWATER LAKE
22.6 acres

CULVERT

CO-65

CULVERT

MIN. 30' FROM EXISTING POND

Well 109201

1
62.6 | 80

Well 96594

SECONDARY PROPERTY ACCESS
NOT USED FOR MINING TRAFFIC

RELIEF DITCH

CULVERT

MIN. 15' FROM DITCH

PERMIT AND AFFECTED AREA:
144.9 acres

CULVERT

STOCKPILED MATERIAL USED IN RECLAMATION

ALL SLOPES RECLAIMED TO 3H:1V
ENTIRE SITE GRADED, TOPSOILED, AND VEGETATED

2
POST MINE LAND USE:
GROUNDWATER LAKE
9.7 acres

2
28.8 | 88

LEGEND

BOUNDARIES
- State or territorial
- County or equivalent
- Incorporated city or equivalent

BUILDINGS AND RELATED STRUCTURES
- Building
- Well (other than water) — Well Name
- Fence

LAND SURVEYS
- Public Land Survey System
- Range or Township line
  - Range or Township labels — R1E T2N
- Section line
  - Section numbers — 1-36
- Mining claim or property boundary

ROADS AND RELATED FEATURES
- Highway
- Light duty road, paved
- Light duty road, gravel
- Unimproved road
- Gate on road
- Railroad

RIVERS, LAKES, SHORELINES, AND CANALS
- Perennial stream/ditch
- Perennial river
- Perennial lake/pond
- Waterwell — Well Name
- Drainage Directions
- Drainage Basin
- Floodplain & Floodway

DRAINAGE BASINS
Basin 1 — Area (acres): 62.6 — Composite Curve Number: 80 — Basin Destination: 1

VEGETATION
- Agricultural Fields
- Rangeland
- Woodlands & Trees
- Wetlands (NWI 1983)

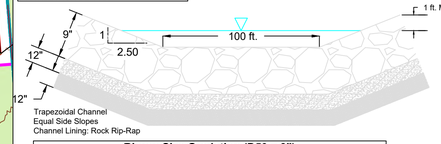
TRANSMISSION LINES AND PIPELINES
- Power transmission line; pole; tower
- Power transmission line, buried
- Telephone/data line, above ground
- Telephone/data line, buried
- Pipeline (non-water), above ground
- Pipeline (non-water), buried

MINING BOUNDARIES
- DRMS Permit Boundary
- Disturbed Area

BASELINE CONTOURS
- Index — Approximate of indefinite
- Intermediate — Approximate of indefinite
- Supplementary

RECLAMATION CONTOURS
- Index — Approximate of indefinite
- Intermediate — Approximate of indefinite
- Dump

DETAIL 1 - INFLOW/OUTFLOW STRUCTURE
INSTALLATION DETAILS



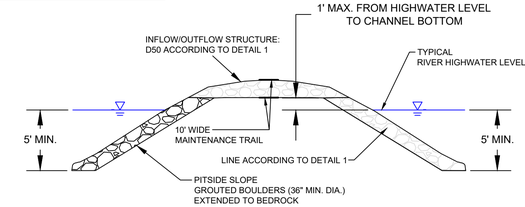
Trapezoidal Channel
Equal Side Slopes
Channel Lining: Rock Rip-Rap

Riprap Size Gradation (D50 = 9")

Typical Stone Dimension	Percent Smaller	Layer Thickness
12"	100	
9"	50	18"
5"	0	
Bedding		
3" sieve	100-90	12"
3/4" sieve	90-20	
#4 sieve	20-0	12"
#200 sieve	3-0	

NOTES:
INSTALL LINING FROM 5' BELOW HIGH WATER LEVEL

DETAIL 2 - INFLOW/OUTFLOW STRUCTURE
INSTALLATION DETAILS



NOTE: INFLOW/OUTFLOW STRUCTURE DESIGN BASED ON MILE HIGH DRAINAGE DISTRICT GUIDANCE IN *TECHNICAL REVIEW GUIDELINES FOR GRAVEL MINING & WATER STORAGE ACTIVITIES WITHIN OR ADJACENT TO 100-YEAR FLOODPLAINS (SECTION 2.4.5 - SIDE CHANNEL SPILLWAY; FIGURE 2.8 - RIPRAP SPILLWAY STABILIZATION)*

INFLOW/OUTFLOW STRUCTURES WILL BE BUILT DURING FINAL RECLAMATION IF THE HIGHWALL CREST IS WITHIN 400' OF THE RIVER BANK.

F-1 Reclamation Plan

Delta Paving Gravel Pit

DRMS Permit Number: M-1998-105 — **Elam Construction**

Mine Entry Location:	Latitude: 38.76815	Longitude: -107.99419	
State: CO	County: Delta	Nearest Town: Delta	
Section: 10	Township: 15S	Range: 95W	PM: 6th
Major Watershed:	Gunnison River	MSHA ID: N/A	

Map Scale: 1": 200'

0 — 200 — 400

Map Georeferencing Information: **Datum:** NAD83 **Projection:** CO CENTRAL

Survey Source: Drone	**Drawn by:** SAC	Date: 09/13/22
Imagery Source: Google	**Checked by:** BEL	Date: 09/13/22
Survey Date: 11/18/21	**Approved by:** BEL	Date: 09/13/22
Imagery Date: ----		

File Name: Delta Paving 221116

Lewicki & Associates
3375 West Powers Circle Littleton, CO USA 80123 (303)-346-5196 info@lewicki.biz

COLORADO LICENSED — WILLIAM E. LAMBERT — 47351 — 12/08/22 — PROFESSIONAL ENGINEER

RULE 6.5: GEOTECHNICAL STABILITY EXHIBIT

There are no known geologic hazards on the proposed site. Based on a slope stability analysis, buildings or other structures within 200' of the Delta Paving Gravel Pit affected area will not be affected by mining excavation. Sufficient buffers will be maintained to neighboring property lines. Maps C-2 and F-1 shows these buffers. Map C-3 shows the mining and reclamation slopes of the mine. A standard slope in Phase 4 was analyzed for stability as it is the closest to offsite structures like fences and the state highway.

The material properties are derived from Table 2.5 in the SME Mining Reference Handbook[1] and Table 3.1 in Stability Analysis of Earth Slopes (Huang)[2], as there is no site-specific sample data of the material available. Therefore, all materials are matched to a classification from this table that best matches the materials in terms of description. The native alluvial material is best classified as sand and gravel with a mixed grain size. From the SME table, sand and gravel with a mixed grain size has an internal angle of friction of 45 degrees and no cohesion. A layer of overburden/topsoil lies atop of the sand and gravel. It is described in the soil survey for this area as silty clay loam. This best matches the description for ML-CL soils (mixture of inorganic silts and clays) from Huang which has an internal angle of friction of 32 degrees and modest cohesion.

The final mining (2H:1V), final reclamation (3H:1V), and active highwall (near vertical) slopes were analyzed. Mining will be conducted at the active highwall angle until the highwall has reached the half-way point of the final mining slope. Then the vertical active highwall slope will be knocked down to the final mining slope of 2H:1V. Then it will be backfilled with overburden/topsoil to the final reclamation slope of 3H:1V.

A surcharge distributed load representing the topsoil berm placed along the west end of the slope has been included in the GALENA analysis.

1. Mining and Reclamation Slopes

Factor of Safety is expressed in terms of strength divided by stress as a ratio. It is arrived at by an iterative computer process where a slope failure is assumed, the strength and stress of that slope failure are calculated, and those values are compared to determine a lowest factor of safety. In the case of the Delta Paving slope stability analysis, the Bishop's Method of Slices was the iterative calculation used, and the software GALENA was used to model slopes and calculate the factor of safety. One slope closest to major structures (see Figure GS-1) was

[1] Original source: Houk and Bray 1977

[2] Source: Huang, Y. *Stability Analysis of Earth Slopes*. 1983. **Table 3.1 Average Effective Shear Strength of Compacted Soils.**

analyzed to look at the factor of safety. Table GS-1 lists the analysis conducted and their respective factors of safety.

The lowest factor of safety for permanent slopes was 1.91 at Final Reclamation. While the Active Highwall has a Factor of Safety below the CDRMS permanent slope minimum (1.5), the FoS = 1.5 failure circle was calculated to determine if that failure circle would cause offsite damage. The distance between the lower FoS failure circle or the FoS = 1.5 failure circle is also shown in Table GS-1.

GALENA data tables and analysis result figures are attached as Appendix GS-1.

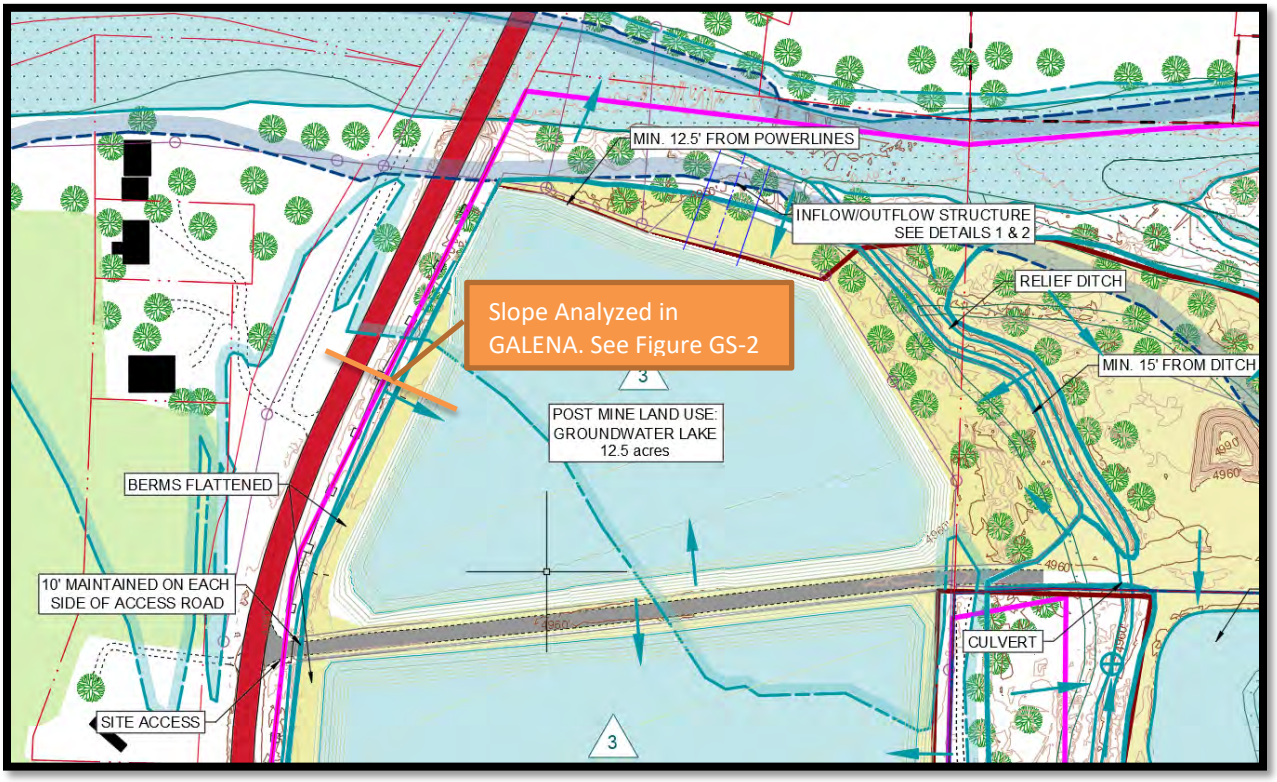


Figure GS-1. Locations of Slope Stability Analysis from Map F-1

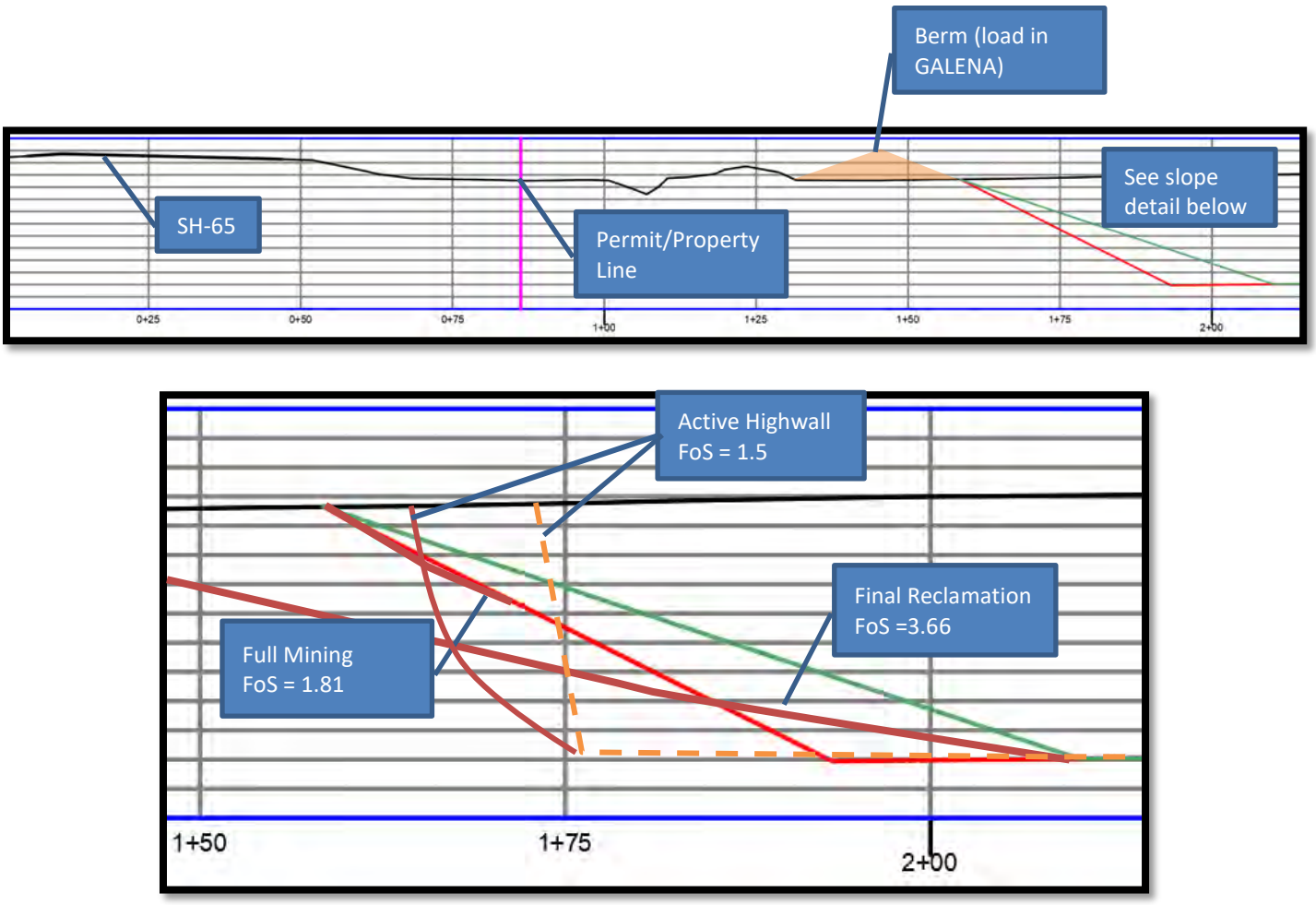


Figure GS-2. Cross Section with Failure Circles

Table GS-1. Factors of Safety for Slope Stability

Slope Condition	Lowest Factor of Safety	Distance from Failure Circle to Nearest Structure
Full Mining	1.81	Roughly 12.5-ft to a powerline.
Final Reclamation	3.66	Roughly 12.5-ft to a powerline.
Active Highwall	<1.5	Roughly 19-ft to a powerline.

2. Conclusion

The Final Reclamation slope has a minimum factor of safety (FoS = 3.66) of greater than 1.5. The Final Mining slope also has a minimum FoS greater than 1.5 (1.81). While a Full Mining slope failure circle was identified at <1.5 (GALENA Analysis 2, FoS = 1.32), it was constrained to a very small failure exclusively within the topsoil/overburden material and is not indicative of the overall slope stability.

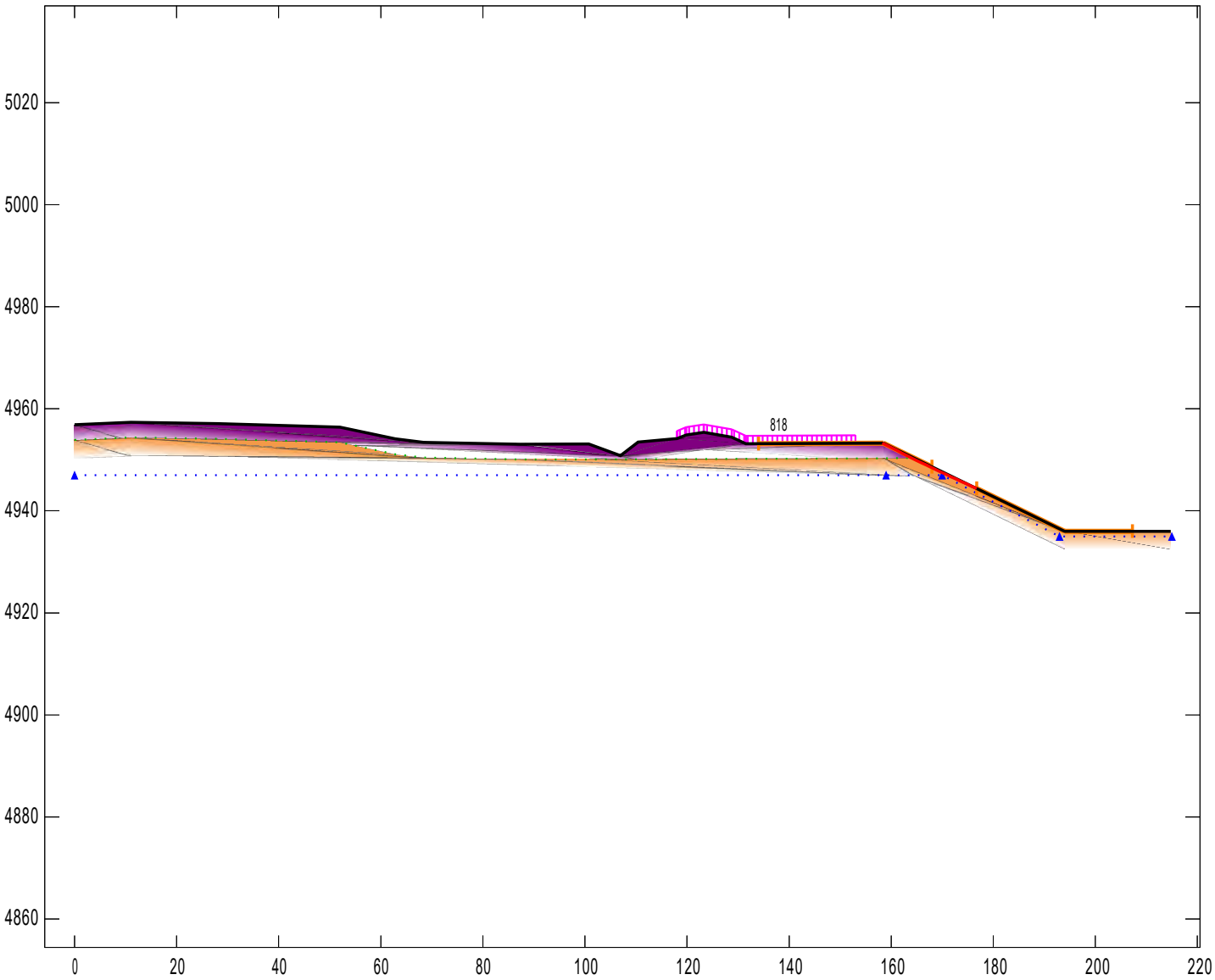
The Active Highwall's lowest FoS are below the minimum of 1.5; this is to be expected from a vertical slope during operations. This slope is not permanent. To ensure that this slope does not risk offsite structures, the FoS = 1.5 failure circle was located to determine its extents. The FoS = 1.5 failure circle is within the disturbance area of the pit. No failure circle reaches the permit boundary or offsite structures.

The slope stability analysis in this permit has been prepared according to appropriate engineering standards and practices.

Ben Langenfeld, P.E.

P.E.# 0047151

APPENDIX GS-1 GALENA INFORMATION



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Sand and gravel, mixed grain size

2: Mixture of inorganic silts and clays

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.81

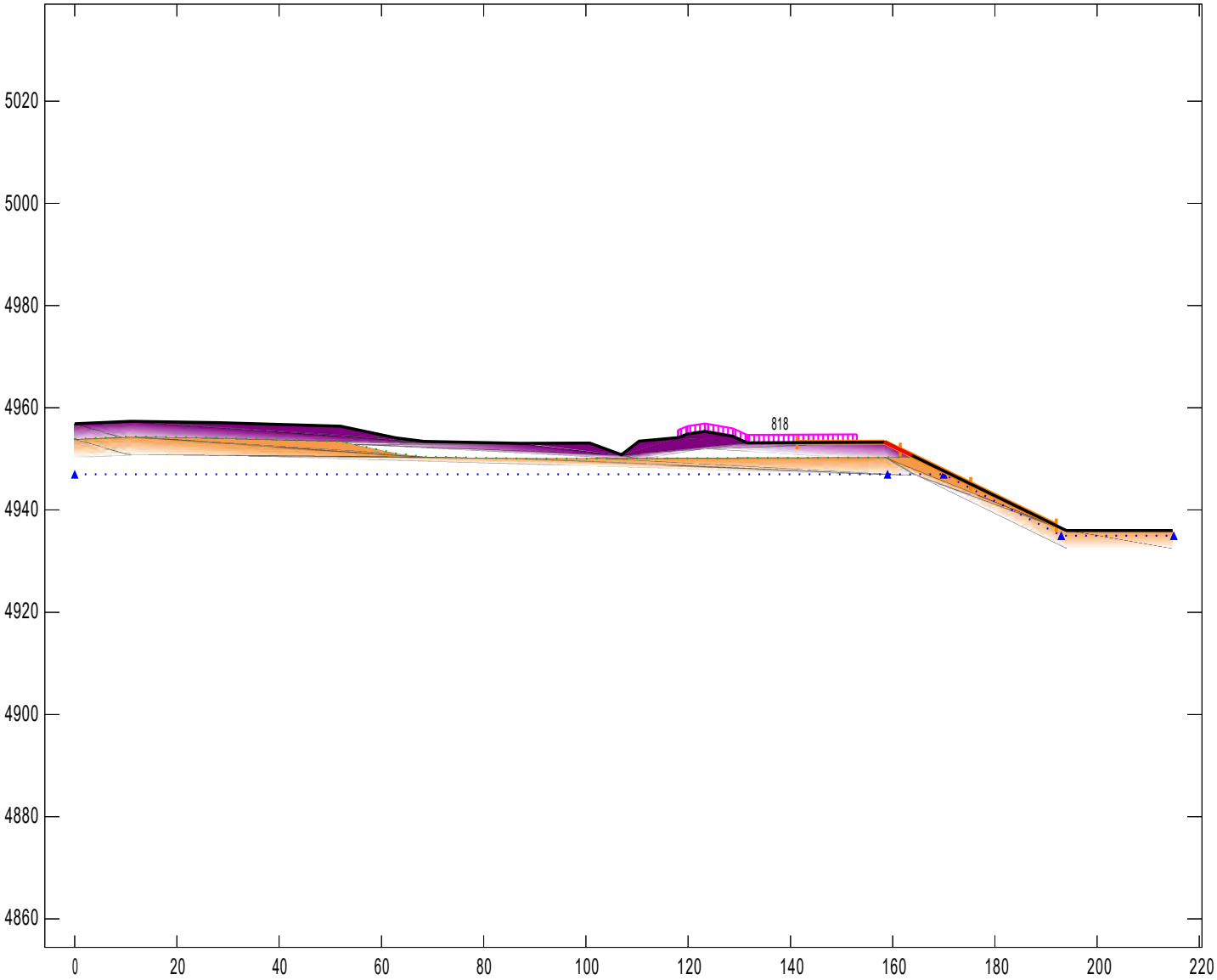
Edited: 9 Dec 2022

Processed: 9 Dec 2022

Project Delta Paving
Full Mining Slope

File: E:\Work\GLA Dropbox\Ben Langenfeld\Elam\Delta Paving\DRMS\Adequacy\Geotech\Delta Paving Geotech.gmf

Lewicki & Associates



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Sand and gravel, mixed grain size

2: Mixture of inorganic silts and clays

Analysis 2

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular (Critical Seed)

Results

Critical Factor of Safety: 1.32

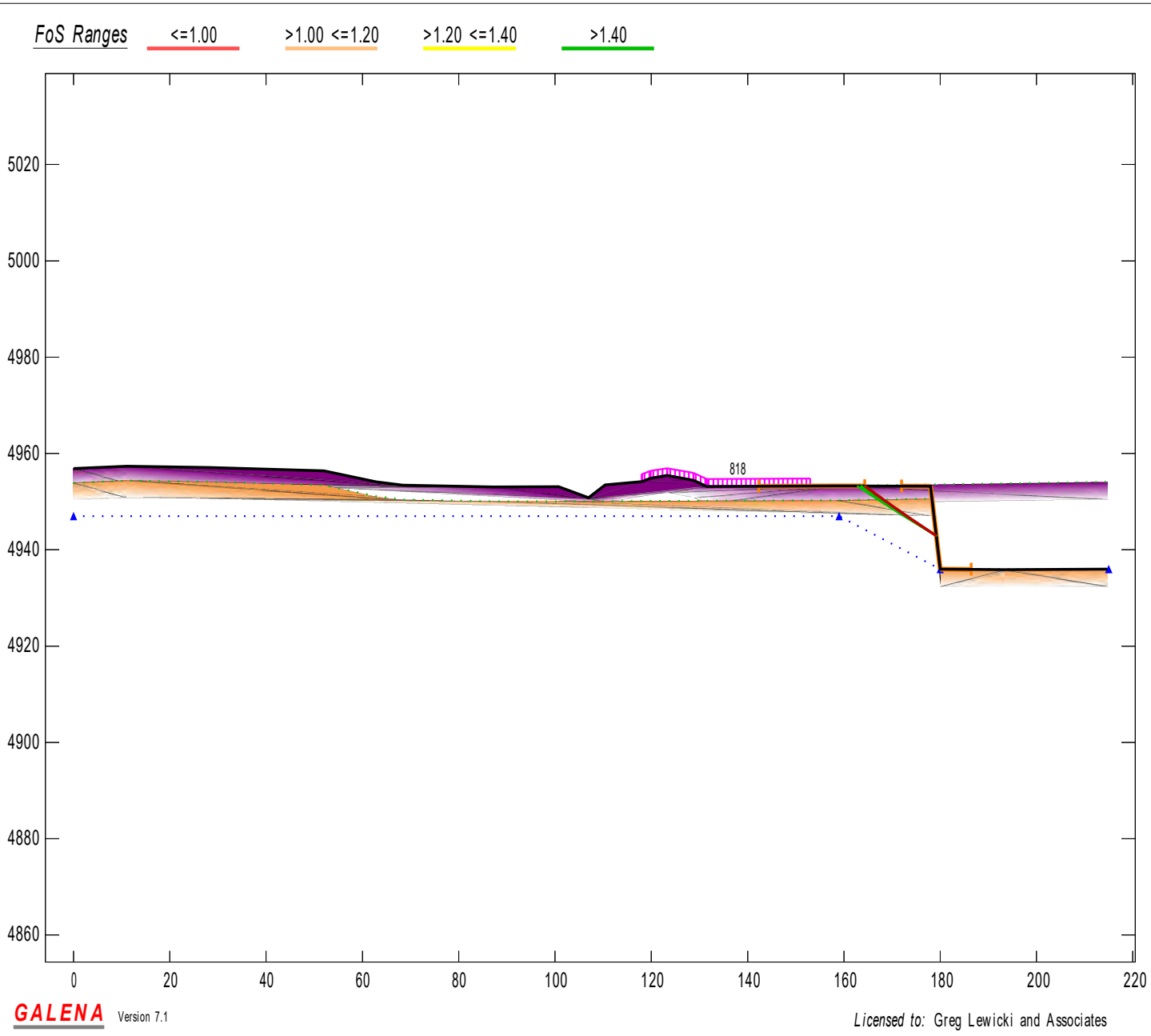
Edited: 9 Dec 2022

Processed: 9 Dec 2022

Project Delta Paving
Full Mining Slope

File: E:\Work\GLA Dropbox\Ben Langenfeld\Elam\Delta Paving\DRMS\Adequacy\Geotech\Delta Paving Geotech.gmf

Lewicki & Associates



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Sand and gravel, mixed grain size

2: Mixture of inorganic silts and clays

Analysis 3

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.41

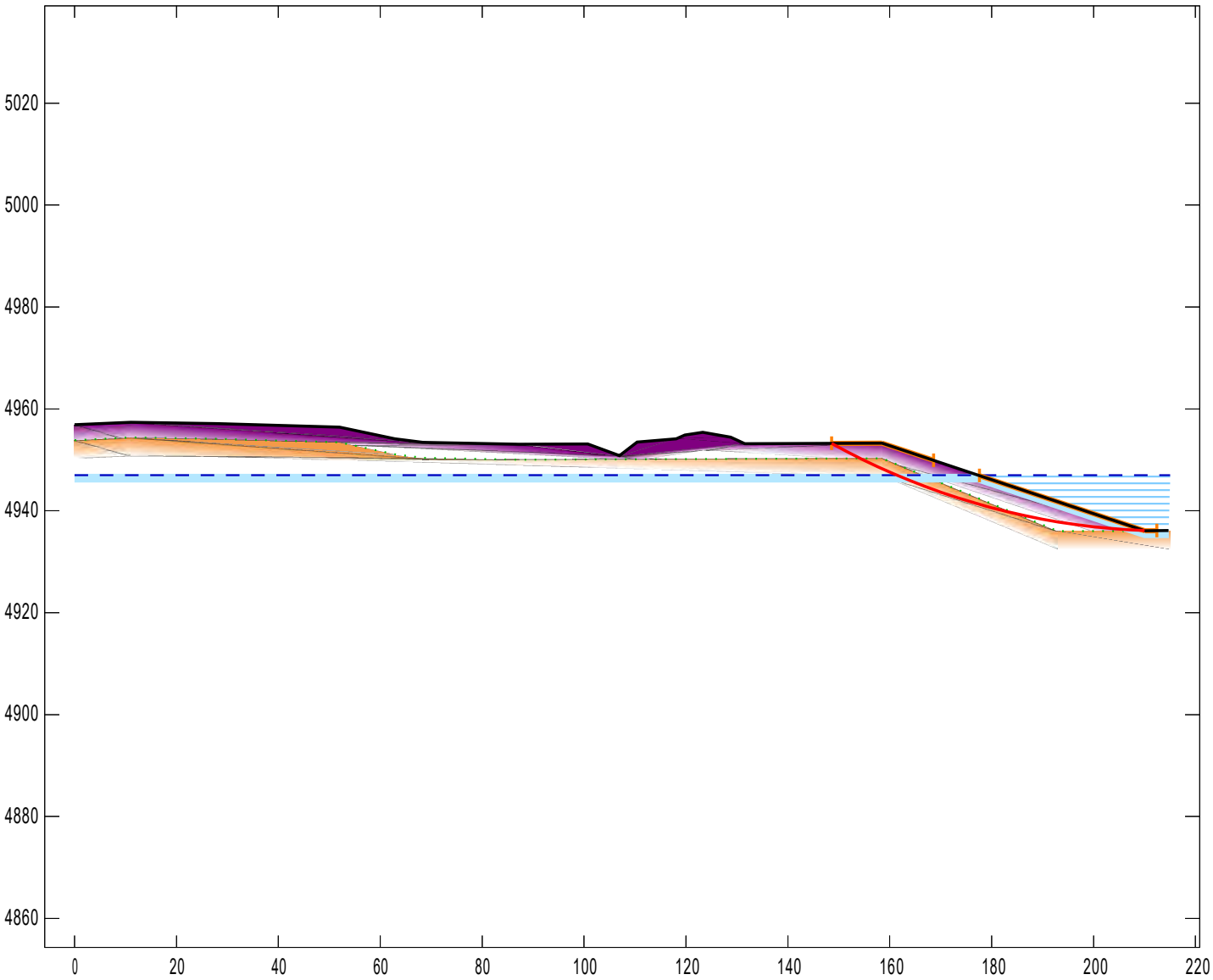
Edited: 9 Dec 2022

Processed: 9 Dec 2022

Project Delta Paving
Active Highwall

File: E:\Work\GLA Dropbox\Ben Langenfeld\Elam\Delta Paving\DRMS\Adequacy\Geotech\Delta Paving Geotech.gmf

Lewicki & Associates



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Sand and gravel, mixed grain size

2: Mixture of inorganic silts and clays

Analysis 4

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 5.64

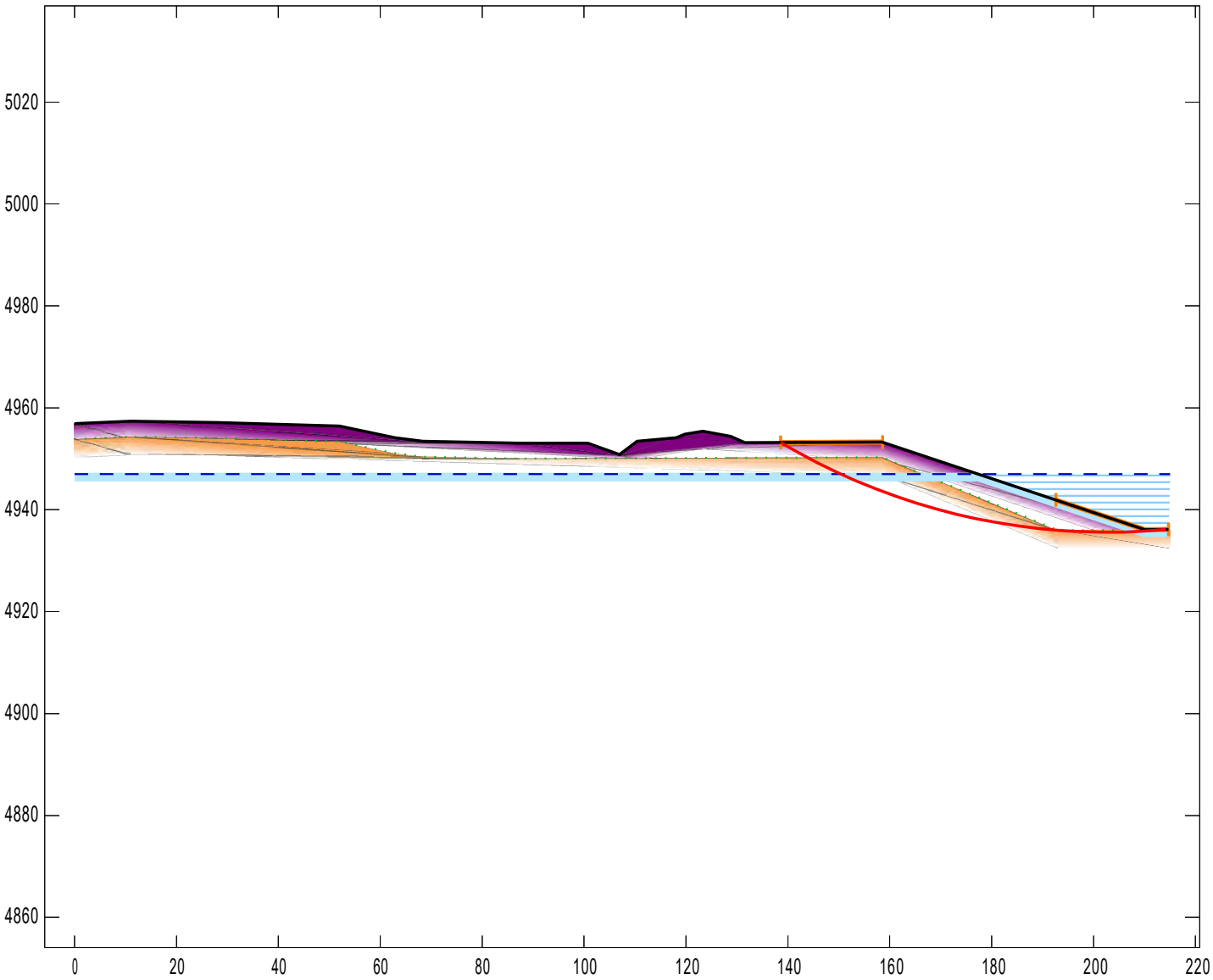
Edited: 9 Dec 2022

Processed: 9 Dec 2022

Project Delta Paving
Final Reclamation

File: E:\Work\GLA Dropbox\Ben Langenfeld\Elam\Delta Paving\DRMS\Adequacy\Geotech\Delta Paving Geotech.gmf

Lewicki & Associates



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Sand and gravel, mixed grain size

2: Mixture of inorganic silts and clays

Analysis 5

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular (Critical Seed)

Results

Critical Factor of Safety: 3.83

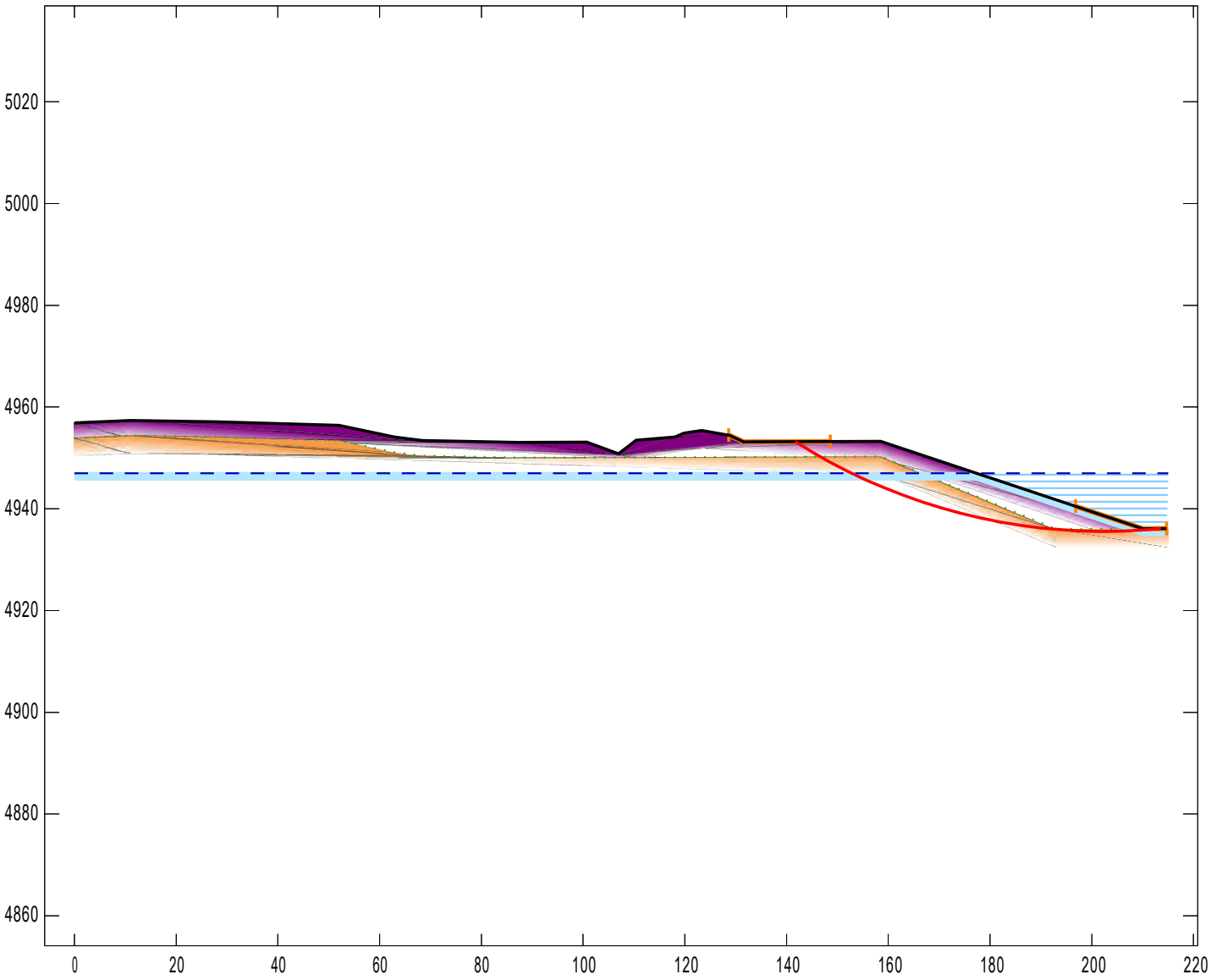
Edited: 9 Dec 2022

Processed: 9 Dec 2022

Project Delta Paving
Final Reclamation

File: E:\Work\GLA Dropbox\Ben Langenfeld\Elam\Delta Paving\DRMS\Adequacy\Geotech\Delta Paving Geotech.gmf

Lewicki & Associates



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Sand and gravel, mixed grain size

2: Mixture of inorganic silts and clays

Analysis 6

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular (Critical Seed)

Results

Critical Factor of Safety: 3.66

Edited: 9 Dec 2022

Processed: 9 Dec 2022

Project Delta Paving
Final Reclamation

File: E:\Work\GLA Dropbox\Ben Langenfeld\Elam\Delta Paving\DRMS\Adequacy\Geotech\Delta Paving Geotech.gmf

Lewicki & Associates

Project: Delta Paving
File: E:\Work\GLA Dropbox\Ben Langenfeld\Elam\Delta Paving\DRMS\Adequacy\Geotech\Delta Paving Geotech.gmf
Processed: 09 Dec 2022 10:52:05

DATA: Analysis 1 - Full Mining Slope

Material Properties (2 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and gravel, mixed grain size

Cohesion	Phi	UnitWeight	Ru
0.00	45.0	110.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Mixture of inorganic silts and clays

Cohesion	Phi	UnitWeight	Ru
0.00	32.0	109.00	Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (2 profiles)

Profile: 1 (17 points) Material beneath: 2 - Mixture of inorganic silts and clays

0.00	4956.88	11.06	4957.37	28.11	4957.10	52.01	4956.41	62.85	4954.11
68.36	4953.42	87.23	4953.05	100.72	4953.09	106.98	4950.82	110.43	4953.46
118.08	4954.14	119.80	4954.85	123.30	4955.41	128.76	4954.42	131.54	4953.15
158.47	4953.28	214.69	4954.12						

Profile: 2 (10 points) Material beneath: 1 - Sand and gravel, mixed grain size

0.00	4953.88	11.06	4954.37	28.11	4954.10	52.01	4953.41	62.85	4951.11
68.36	4950.42	87.23	4950.05	100.72	4950.09	158.47	4950.28	214.69	4951.12

Slope Surface (18 points)

0.00	4956.88	11.06	4957.37	28.11	4957.10	52.01	4956.41	62.85	4954.11
68.36	4953.42	87.23	4953.05	100.72	4953.09	106.98	4950.82	110.43	4953.46
118.08	4954.14	119.80	4954.85	123.30	4955.41	128.76	4954.42	131.54	4953.15
158.47	4953.28	194.00	4936.00	214.69	4936.00				

Piezometric Surfaces (1 surface)

Surface within profile: 2 (5 points) - Sand and gravel, mixed grain size

0.00	4947.00	159.00	4947.00	170.00	4947.00	193.00	4935.00	215.00	4935.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects: XL: 151.00 YL: 4953.24 XR: 192.00 YR: 4936.97

Centre: XC: 300.35 YC: 5269.78 Radius: R: 350.00

Distributed Loads (1 load)

Load	X-Left	Pressure	X-Right	Pressure
1	118.00	818.0	153.00	818.0

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	34.00	30.50	15.00
Trial positions within range:	15	15	15

- -

RESULTS: Analysis 1 - Full Mining Slope

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.838

There were: 1898 successful analyses from a total of 3375 trial surfaces
1477 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.81

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	158.29	4953.28	176.75	4944.39	322.06	5269.85	356.43	1.806	<-- Critical Surface
2	158.29	4953.28	176.75	4944.39	322.53	5270.82	357.50	1.807	
3	158.29	4953.28	176.75	4944.39	321.60	5268.89	355.36	1.807	
4	158.29	4953.28	176.75	4944.39	320.67	5266.95	353.21	1.807	
5	158.29	4953.28	176.75	4944.39	321.13	5267.92	354.29	1.807	
6	158.29	4953.28	176.75	4944.39	320.20	5265.99	352.14	1.807	
7	158.29	4953.28	176.75	4944.39	319.74	5265.02	351.07	1.808	
8	158.29	4953.28	176.75	4944.39	319.27	5264.06	350.00	1.808	
9	158.29	4953.28	176.75	4944.39	318.81	5263.09	348.93	1.808	
10	158.29	4953.28	176.75	4944.39	318.34	5262.12	347.86	1.808	
11	158.29	4953.28	176.75	4944.39	317.41	5260.19	345.71	1.808	
12	158.29	4953.28	176.75	4944.39	317.88	5261.16	346.79	1.809	
13	158.29	4953.28	176.75	4944.39	316.95	5259.23	344.64	1.809	
14	158.29	4953.28	176.75	4944.39	316.48	5258.26	343.57	1.809	
15	158.29	4953.28	176.75	4944.39	316.02	5257.30	342.50	1.809	
16	148.57	4953.23	194.18	4936.00	292.12	5264.20	342.50	1.822	
17	148.57	4953.23	194.18	4936.00	292.50	5265.20	343.57	1.822	
18	148.57	4953.23	194.18	4936.00	292.88	5266.21	344.64	1.823	
19	148.57	4953.23	194.18	4936.00	293.26	5267.21	345.71	1.823	
20	148.57	4953.23	194.18	4936.00	293.64	5268.22	346.79	1.824	
21	148.57	4953.23	194.18	4936.00	294.02	5269.22	347.86	1.824	
22	148.57	4953.23	194.18	4936.00	294.40	5270.23	348.93	1.825	
23	148.57	4953.23	194.18	4936.00	294.78	5271.23	350.00	1.825	
24	148.57	4953.23	194.18	4936.00	295.16	5272.23	351.07	1.826	
25	148.57	4953.23	194.18	4936.00	295.54	5273.24	352.14	1.826	
26	148.57	4953.23	194.18	4936.00	295.92	5274.24	353.21	1.827	
27	148.57	4953.23	194.18	4936.00	296.30	5275.25	354.29	1.827	
28	148.57	4953.23	194.18	4936.00	296.68	5276.25	355.36	1.828	
29	148.57	4953.23	194.18	4936.00	297.06	5277.26	356.43	1.828	
30	148.57	4953.23	194.18	4936.00	297.44	5278.26	357.50	1.829	
31	151.00	4953.24	192.00	4936.97	297.58	5262.79	342.50	1.834	
32	151.00	4953.24	192.00	4936.97	297.97	5263.79	343.57	1.835	
33	151.00	4953.24	192.00	4936.97	298.37	5264.79	344.64	1.835	
34	151.00	4953.24	192.00	4936.97	298.76	5265.79	345.71	1.836	
35	151.00	4953.24	192.00	4936.97	299.16	5266.79	346.79	1.836	
36	151.00	4953.24	192.00	4936.97	299.56	5267.78	347.86	1.837	
37	151.00	4953.24	192.00	4936.97	299.95	5268.78	348.93	1.837	
38	151.00	4953.24	192.00	4936.97	300.35	5269.78	350.00	1.838	
39	158.29	4953.28	178.93	4943.33	323.74	5270.19	357.50	1.852	
40	158.29	4953.28	178.93	4943.33	322.81	5268.26	355.36	1.852	
41	158.29	4953.28	178.93	4943.33	323.27	5269.22	356.43	1.852	
42	158.29	4953.28	178.93	4943.33	322.34	5267.29	354.29	1.853	
43	158.29	4953.28	178.93	4943.33	321.88	5266.33	353.21	1.853	
44	158.29	4953.28	178.93	4943.33	321.41	5265.36	352.14	1.853	
45	158.29	4953.28	178.93	4943.33	320.95	5264.39	351.07	1.853	
46	158.29	4953.28	178.93	4943.33	320.48	5263.43	350.00	1.853	
47	158.29	4953.28	178.93	4943.33	320.01	5262.46	348.93	1.854	
48	158.29	4953.28	178.93	4943.33	319.55	5261.50	347.86	1.854	
49	158.29	4953.28	178.93	4943.33	319.08	5260.53	346.79	1.854	
50	158.29	4953.28	178.93	4943.33	318.62	5259.57	345.71	1.854	
51	158.29	4953.28	178.93	4943.33	318.15	5258.60	344.64	1.854	
52	158.29	4953.28	178.93	4943.33	317.69	5257.63	343.57	1.854	
53	158.29	4953.28	178.93	4943.33	317.22	5256.67	342.50	1.855	
54	155.86	4953.27	192.00	4936.97	314.46	5256.83	342.50	1.857	
55	155.86	4953.27	192.00	4936.97	314.90	5257.81	343.57	1.857	
56	155.86	4953.27	192.00	4936.97	315.34	5258.79	344.64	1.858	
57	155.86	4953.27	192.00	4936.97	315.78	5259.77	345.71	1.858	
58	155.86	4953.27	192.00	4936.97	316.22	5260.75	346.79	1.859	
59	155.86	4953.27	192.00	4936.97	316.66	5261.72	347.86	1.859	
60	155.86	4953.27	192.00	4936.97	317.11	5262.70	348.93	1.860	
61	148.57	4953.23	192.00	4936.97	290.10	5265.12	342.50	1.860	
62	155.86	4953.27	192.00	4936.97	317.55	5263.68	350.00	1.860	
63	148.57	4953.23	192.00	4936.97	290.48	5266.13	343.57	1.861	
64	155.86	4953.27	192.00	4936.97	317.99	5264.66	351.07	1.861	
65	155.86	4953.27	192.00	4936.97	318.43	5265.64	352.14	1.861	
66	148.57	4953.23	192.00	4936.97	290.85	5267.13	344.64	1.861	
67	155.86	4953.27	192.00	4936.97	318.87	5266.62	353.21	1.862	
68	148.57	4953.23	192.00	4936.97	291.23	5268.14	345.71	1.862	

69	155.86	4953.27	192.00	4936.97	319.31	5267.59	354.29	1.862
70	148.57	4953.23	192.00	4936.97	291.60	5269.15	346.79	1.862
71	155.86	4953.27	192.00	4936.97	319.75	5268.57	355.36	1.863
72	148.57	4953.23	192.00	4936.97	291.98	5270.15	347.86	1.863
73	153.43	4953.26	192.00	4936.97	305.67	5260.06	342.50	1.863
74	155.86	4953.27	192.00	4936.97	320.19	5269.55	356.43	1.863
75	148.57	4953.23	192.00	4936.97	292.36	5271.16	348.93	1.863
76	153.43	4953.26	192.00	4936.97	306.08	5261.05	343.57	1.863
77	155.86	4953.27	192.00	4936.97	320.63	5270.53	357.50	1.864
78	148.57	4953.23	192.00	4936.97	292.73	5272.16	350.00	1.864
79	153.43	4953.26	192.00	4936.97	306.50	5262.04	344.64	1.864
80	148.57	4953.23	192.00	4936.97	293.11	5273.17	351.07	1.864
81	153.43	4953.26	192.00	4936.97	306.92	5263.03	345.71	1.864
82	148.57	4953.23	192.00	4936.97	293.49	5274.17	352.14	1.865
83	153.43	4953.26	192.00	4936.97	307.34	5264.02	346.79	1.865
84	148.57	4953.23	192.00	4936.97	293.86	5275.18	353.21	1.865
85	153.43	4953.26	192.00	4936.97	307.75	5265.01	347.86	1.865
86	153.43	4953.26	192.00	4936.97	308.17	5265.99	348.93	1.866
87	148.57	4953.23	192.00	4936.97	294.24	5276.19	354.29	1.866
88	153.43	4953.26	192.00	4936.97	308.59	5266.98	350.00	1.866
89	148.57	4953.23	192.00	4936.97	294.62	5277.19	355.36	1.866
90	148.57	4953.23	192.00	4936.97	294.99	5278.20	356.43	1.867
91	153.43	4953.26	192.00	4936.97	309.01	5267.97	351.07	1.867
92	153.43	4953.26	192.00	4936.97	309.42	5268.96	352.14	1.867
93	148.57	4953.23	192.00	4936.97	295.37	5279.20	357.50	1.867
94	153.43	4953.26	192.00	4936.97	309.84	5269.95	353.21	1.868
95	153.43	4953.26	192.00	4936.97	310.26	5270.94	354.29	1.868
96	153.43	4953.26	192.00	4936.97	310.68	5271.93	355.36	1.869
97	153.43	4953.26	192.00	4936.97	311.09	5272.92	356.43	1.869
98	153.43	4953.26	192.00	4936.97	311.51	5273.90	357.50	1.870
99	146.14	4953.22	194.18	4936.00	285.42	5266.12	342.50	1.874

Critical Failure Surface (circle 1)

Intersects: XL: 158.29 YL: 4953.28 XR: 176.75 YR: 4944.39
Centre: XC: 322.06 YC: 5269.85 Radius: R: 356.43

Generated failure surface: (20 points)

158.29	4953.28	159.24	4952.78	160.21	4952.29	161.17	4951.80	162.13	4951.32
163.09	4950.84	164.06	4950.36	165.03	4949.88	166.00	4949.41	166.97	4948.94
167.94	4948.47	168.91	4948.00	169.89	4947.54	170.86	4947.08	171.84	4946.63
172.82	4946.17	173.80	4945.72	174.78	4945.28	175.77	4944.83	176.75	4944.39

Slice Geometry and Properties - Critical Failure Surface (circle 1, 39 slices)

Slice	X-S	Base						PoreWater	
Normal	Test								
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	
Stress	Factor										
1	158.29	0.01	27.2	0.18	0.21	2	0.00	32.0	0.96	0.00	4.43	0.95
2	158.47	0.04	27.3	0.39	0.44	2	0.00	32.0	4.29	0.00	9.39	0.95
3	158.86	0.04	27.3	0.39	0.44	2	0.00	32.0	4.76	0.00	10.43	0.95
4	159.24	0.06	27.1	0.48	0.54	2	0.00	32.0	6.52	0.00	11.53	0.95
5	159.72	0.07	27.1	0.48	0.54	2	0.00	32.0	7.16	0.00	12.66	0.95
6	160.21	0.07	26.9	0.48	0.54	2	0.00	32.0	7.73	0.00	13.67	0.95
7	160.69	0.08	27.0	0.48	0.54	2	0.00	32.0	8.29	0.00	14.66	0.95
8	161.17	0.08	26.7	0.48	0.54	2	0.00	32.0	8.82	0.00	15.59	0.95
9	161.65	0.08	26.7	0.48	0.54	2	0.00	32.0	9.23	0.00	16.32	0.95
10	162.13	0.09	26.6	0.48	0.54	2	0.00	32.0	9.65	0.00	17.06	0.95
11	162.61	0.09	26.6	0.48	0.54	2	0.00	32.0	10.01	0.00	17.70	0.95
12	163.09	0.09	26.4	0.48	0.53	2	0.00	32.0	10.21	0.00	18.26	0.95
13	163.57	0.10	26.4	0.48	0.53	2	0.00	32.0	10.44	0.00	18.67	0.95
14	164.05	0.08	26.2	0.41	0.45	1	0.00	45.0	9.08	0.00	17.60	0.88
15	164.45	0.12	26.3	0.57	0.64	1	0.00	45.0	13.11	0.00	17.93	0.88
16	165.03	0.10	26.0	0.48	0.54	1	0.00	45.0	11.19	0.00	18.18	0.88
17	165.51	0.10	26.0	0.48	0.54	1	0.00	45.0	11.24	0.00	18.26	0.88
18	166.00	0.10	25.9	0.49	0.54	1	0.00	45.0	11.29	0.00	18.33	0.88
19	166.48	0.10	25.9	0.49	0.54	1	0.00	45.0	11.26	0.00	18.29	0.88
20	166.97	0.10	25.7	0.49	0.54	1	0.00	45.0	11.20	0.00	18.19	0.88
21	167.45	0.10	25.7	0.49	0.54	1	0.00	45.0	11.07	0.00	17.98	0.88
22	167.94	0.10	25.5	0.49	0.54	1	0.00	45.0	10.93	0.00	17.76	0.88
23	168.43	0.10	25.5	0.49	0.54	1	0.00	45.0	10.69	0.00	17.37	0.88
24	168.91	0.09	25.4	0.49	0.54	1	0.00	45.0	10.42	0.00	16.93	0.88
25	169.40	0.09	25.4	0.49	0.54	1	0.00	45.0	10.13	0.00	16.47	0.88
26	169.89	0.09	25.2	0.49	0.54	1	0.00	45.0	9.75	0.00	15.85	0.88
27	170.38	0.08	25.2	0.49	0.54	1	0.00	45.0	9.33	0.00	15.17	0.88
28	170.86	0.08	25.0	0.49	0.54	1	0.00	45.0	8.85	0.00	14.39	0.88
29	171.35	0.08	25.0	0.49	0.54	1	0.00	45.0	8.32	0.00	13.53	0.88
30	171.84	0.07	24.8	0.49	0.54	1	0.00	45.0	7.78	0.00	12.66	0.88
31	172.33	0.07	24.8	0.49	0.54	1	0.00	45.0	7.18	0.00	11.67	0.88
32	172.82	0.06	24.7	0.49	0.54	1	0.00	45.0	6.50	0.00	10.58	0.88
33	173.31	0.05	24.7	0.49	0.54	1	0.00	45.0	5.82	0.00	9.46	0.88
34	173.80	0.05	24.5	0.49	0.54	1	0.00	45.0	5.04	0.00	8.19	0.88
35	174.29	0.04	24.5	0.49	0.54	1	0.00	45.0	4.22	0.00	6.86	0.88
36	174.78	0.03	24.3	0.49	0.54	1	0.00	45.0	3.35	0.00	5.46	0.88
37	175.27	0.02	24.3	0.49	0.54	1	0.00	45.0	2.48	0.00	4.04	0.88
38	175.77	0.01	24.2	0.49	0.54	1	0.00	45.0	1.51	0.00	2.45	0.88
39	176.26	0.00	24.2	0.49	0.54	1	0.00	45.0	0.50	0.00	0.82	0.88
		--------			-------				----------		

X-S Area: 2.83 Path Length: 20.50 X-S Weight: 310.29

DATA: Analysis 2 - Full Mining Slope

Material Properties (2 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and gravel, mixed grain size
Cohesion Phi UnitWeight Ru
0.00 45.0 110.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Mixture of inorganic silts and clays
Cohesion Phi UnitWeight Ru
0.00 32.0 109.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (2 profiles)

Profile: 1 (17 points) Material beneath: 2 - Mixture of inorganic silts and clays
0.00 4956.88 11.06 4957.37 28.11 4957.10 52.01 4956.41 62.85 4954.11
68.36 4953.42 87.23 4953.05 100.72 4953.09 106.98 4950.82 110.43 4953.46
118.08 4954.14 119.80 4954.85 123.30 4955.41 128.76 4954.42 131.54 4953.15
158.47 4953.28 214.69 4954.12
Profile: 2 (10 points) Material beneath: 1 - Sand and gravel, mixed grain size
0.00 4953.88 11.06 4954.37 28.11 4954.10 52.01 4953.41 62.85 4951.11
68.36 4950.42 87.23 4950.05 100.72 4950.09 158.47 4950.28 214.69 4951.12

Slope Surface (18 points)

0.00 4956.88 11.06 4957.37 28.11 4957.10 52.01 4956.41 62.85 4954.11
68.36 4953.42 87.23 4953.05 100.72 4953.09 106.98 4950.82 110.43 4953.46
118.08 4954.14 119.80 4954.85 123.30 4955.41 128.76 4954.42 131.54 4953.15
158.47 4953.28 194.00 4936.00 214.69 4936.00

Piezometric Surfaces (1 surface)

Surface within profile: 2 (5 points) - Sand and gravel, mixed grain size
0.00 4947.00 159.00 4947.00 170.00 4947.00 193.00 4935.00 215.00 4935.00

Failure Surface (Critical, from previous analysis)

Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL: 158.29 YL: 4953.28 XR: 176.75 YR: 4944.39
Centre: XC: 322.06 YC: 5269.85 Radius: R: 356.43

Distributed Loads (1 load)

Load	X-Left	Pressure	X-Right	Pressure
1	118.00	818.0	153.00	818.0

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	34.00	30.50	15.00
Trial positions within range:	15	15	15

- -

RESULTS: Analysis 2 - Full Mining Slope

Bishop Simplified Method of Analysis - Circular Failure Surface
---
Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.806

There were: 2629 successful analyses from a total of 3375 trial surfaces
746 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.32

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	158.29	4953.28	163.68	4950.75	309.74	5268.81	350.00	1.323	<-- Critical Surface
2	158.29	4953.28	163.68	4950.75	311.56	5272.69	354.29	1.323	
3	158.29	4953.28	163.68	4950.75	309.28	5267.84	348.93	1.323	
4	158.29	4953.28	163.68	4950.75	311.10	5271.72	353.21	1.323	
5	158.29	4953.28	163.68	4950.75	310.65	5270.75	352.14	1.323	
6	158.29	4953.28	163.68	4950.75	312.47	5274.63	356.43	1.323	
7	158.29	4953.28	163.68	4950.75	312.92	5275.60	357.50	1.323	
8	158.29	4953.28	163.68	4950.75	315.20	5280.45	362.86	1.323	
9	158.29	4953.28	163.68	4950.75	314.29	5278.51	360.71	1.323	
10	158.29	4953.28	163.68	4950.75	314.75	5279.48	361.79	1.323	
11	158.29	4953.28	163.68	4950.75	312.01	5273.66	355.36	1.323	
12	158.29	4953.28	163.68	4950.75	313.84	5277.54	359.64	1.323	
13	158.29	4953.28	163.68	4950.75	310.19	5269.78	351.07	1.323	
14	158.29	4953.28	163.68	4950.75	315.66	5281.42	363.93	1.323	
15	158.29	4953.28	163.68	4950.75	313.38	5276.57	358.57	1.323	
16	158.29	4953.28	165.86	4949.69	311.61	5266.71	348.93	1.349	
17	158.29	4953.28	165.86	4949.69	317.12	5278.33	361.79	1.349	
18	158.29	4953.28	165.86	4949.69	318.04	5280.27	363.93	1.349	
19	158.29	4953.28	165.86	4949.69	312.53	5268.65	351.07	1.349	
20	158.29	4953.28	165.86	4949.69	312.99	5269.62	352.14	1.349	
21	158.29	4953.28	165.86	4949.69	314.37	5272.52	355.36	1.349	
22	158.29	4953.28	165.86	4949.69	313.45	5270.59	353.21	1.349	
23	158.29	4953.28	165.86	4949.69	312.07	5267.68	350.00	1.349	
24	158.29	4953.28	165.86	4949.69	313.91	5271.55	354.29	1.349	
25	158.29	4953.28	165.86	4949.69	315.29	5274.46	357.50	1.349	
26	158.29	4953.28	165.86	4949.69	316.67	5277.36	360.71	1.349	
27	158.29	4953.28	165.86	4949.69	316.21	5276.40	359.64	1.349	
28	158.29	4953.28	165.86	4949.69	317.58	5279.30	362.86	1.349	
29	158.29	4953.28	165.86	4949.69	314.83	5273.49	356.43	1.349	
30	158.29	4953.28	165.86	4949.69	315.75	5275.43	358.57	1.349	
31	158.29	4953.28	161.50	4951.81	307.91	5275.60	355.36	1.358	
32	158.29	4953.28	161.50	4951.81	308.35	5276.58	356.43	1.358	
33	158.29	4953.28	161.50	4951.81	308.80	5277.55	357.50	1.358	
34	158.29	4953.28	161.50	4951.81	311.03	5282.42	362.86	1.359	
35	158.29	4953.28	161.50	4951.81	305.67	5270.73	350.00	1.359	
36	158.29	4953.28	161.50	4951.81	305.23	5269.76	348.93	1.359	
37	158.29	4953.28	161.50	4951.81	309.24	5278.52	358.57	1.359	
38	158.29	4953.28	161.50	4951.81	306.12	5271.71	351.07	1.359	
39	158.29	4953.28	161.50	4951.81	310.14	5280.47	360.71	1.359	
40	158.29	4953.28	161.50	4951.81	309.69	5279.50	359.64	1.359	
41	158.29	4953.28	161.50	4951.81	310.58	5281.45	361.79	1.359	
42	158.29	4953.28	161.50	4951.81	307.01	5273.65	353.21	1.359	
43	158.29	4953.28	161.50	4951.81	306.57	5272.68	352.14	1.359	
44	158.29	4953.28	161.50	4951.81	307.46	5274.63	354.29	1.359	
45	158.29	4953.28	161.50	4951.81	311.48	5283.40	363.93	1.359	
46	158.29	4953.28	168.04	4948.63	317.54	5274.55	358.57	1.462	
47	158.29	4953.28	168.04	4948.63	318.46	5276.48	360.71	1.462	
48	158.29	4953.28	168.04	4948.63	318.92	5277.45	361.79	1.462	
49	158.29	4953.28	168.04	4948.63	319.38	5278.42	362.86	1.462	
50	158.29	4953.28	168.04	4948.63	319.84	5279.38	363.93	1.462	
51	158.29	4953.28	168.04	4948.63	316.61	5272.61	356.43	1.462	
52	158.29	4953.28	168.04	4948.63	315.69	5270.68	354.29	1.462	
53	158.29	4953.28	168.04	4948.63	317.07	5273.58	357.50	1.463	
54	158.29	4953.28	168.04	4948.63	318.00	5275.51	359.64	1.463	
55	158.29	4953.28	168.04	4948.63	316.15	5271.65	355.36	1.463	
56	158.29	4953.28	168.04	4948.63	313.84	5266.81	350.00	1.463	
57	158.29	4953.28	168.04	4948.63	314.31	5267.78	351.07	1.463	
58	158.29	4953.28	168.04	4948.63	315.23	5269.71	353.21	1.463	
59	158.29	4953.28	168.04	4948.63	314.77	5268.74	352.14	1.463	
60	158.29	4953.28	168.04	4948.63	313.38	5265.84	348.93	1.463	
61	158.29	4953.28	170.21	4947.57	320.91	5277.65	362.86	1.576	
62	158.29	4953.28	170.21	4947.57	321.38	5278.62	363.93	1.576	
63	158.29	4953.28	170.21	4947.57	320.45	5276.68	361.79	1.576	
64	158.29	4953.28	170.21	4947.57	319.99	5275.72	360.71	1.577	
65	158.29	4953.28	170.21	4947.57	319.53	5274.75	359.64	1.577	
66	158.29	4953.28	170.21	4947.57	317.67	5270.89	355.36	1.577	
67	158.29	4953.28	170.21	4947.57	319.06	5273.78	358.57	1.577	
68	158.29	4953.28	170.21	4947.57	318.60	5272.82	357.50	1.577	
69	158.29	4953.28	170.21	4947.57	318.14	5271.85	356.43	1.577	
70	158.29	4953.28	170.21	4947.57	317.21	5269.92	354.29	1.578	
71	158.29	4953.28	170.21	4947.57	315.82	5267.02	351.07	1.578	
72	158.29	4953.28	170.21	4947.57	316.75	5268.95	353.21	1.578	
73	158.29	4953.28	170.21	4947.57	315.36	5266.05	350.00	1.578	

74	158.29	4953.28	170.21	4947.57	316.29	5267.99	352.14	1.578
75	158.29	4953.28	170.21	4947.57	314.90	5265.09	348.93	1.578
76	158.29	4953.28	172.39	4946.51	322.77	5277.92	363.93	1.671
77	158.29	4953.28	172.39	4946.51	321.84	5275.98	361.79	1.672
78	158.29	4953.28	172.39	4946.51	322.30	5276.95	362.86	1.672
79	158.29	4953.28	172.39	4946.51	321.38	5275.02	360.71	1.672
80	158.29	4953.28	172.39	4946.51	320.45	5273.09	358.57	1.672
81	158.29	4953.28	172.39	4946.51	320.91	5274.05	359.64	1.672
82	158.29	4953.28	172.39	4946.51	319.06	5270.19	355.36	1.673
83	158.29	4953.28	172.39	4946.51	319.52	5271.15	356.43	1.673
84	158.29	4953.28	172.39	4946.51	319.99	5272.12	357.50	1.673
85	158.29	4953.28	172.39	4946.51	318.60	5269.22	354.29	1.673
86	158.29	4953.28	172.39	4946.51	318.13	5268.25	353.21	1.673
87	158.29	4953.28	172.39	4946.51	317.67	5267.29	352.14	1.673
88	158.29	4953.28	172.39	4946.51	316.74	5265.36	350.00	1.674
89	158.29	4953.28	172.39	4946.51	317.20	5266.32	351.07	1.674
90	158.29	4953.28	172.39	4946.51	316.28	5264.39	348.93	1.674
91	158.29	4953.28	174.57	4945.45	323.61	5276.29	362.86	1.747
92	158.29	4953.28	174.57	4945.45	324.07	5277.25	363.93	1.747
93	158.29	4953.28	174.57	4945.45	323.15	5275.32	361.79	1.747
94	158.29	4953.28	174.57	4945.45	322.22	5273.39	359.64	1.748
95	158.29	4953.28	174.57	4945.45	322.68	5274.35	360.71	1.748
96	158.29	4953.28	174.57	4945.45	321.75	5272.42	358.57	1.748
97	158.29	4953.28	174.57	4945.45	321.29	5271.46	357.50	1.748
98	158.29	4953.28	174.57	4945.45	320.82	5270.49	356.43	1.748
99	158.29	4953.28	174.57	4945.45	320.36	5269.52	355.36	1.748

Critical Failure Surface (circle 1)

Intersects: XL: 158.29 YL: 4953.28 XR: 163.68 YR: 4950.75
Centre: XC: 309.74 YC: 5268.81 Radius: R: 350.00

Generated failure surface: (20 points)

158.29 4953.28 158.57 4953.14 158.85 4953.01 159.13 4952.87
159.42 4952.74
159.70 4952.60 159.98 4952.47 160.27 4952.34 160.55 4952.20
160.84 4952.07
161.12 4951.93 161.40 4951.80 161.69 4951.67 161.97 4951.54
162.26 4951.40
162.54 4951.27 162.82 4951.14 163.11 4951.01 163.39 4950.88
163.68 4950.75

Slice Geometry and Properties - Critical Failure Surface (circle 1, 39 slices)

Slice	X-S	Base						PoreWater	
Normal	Test								
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	
Stress	Factor										
1	158.29	0.00	25.5	0.09	0.10	2	0.00	32.0	0.23	0.00	2.00	0.90
2	158.38	0.01	25.5	0.09	0.10	2	0.00	32.0	0.67	0.00	5.95	0.90
3	158.47	0.01	25.6	0.10	0.11	2	0.00	32.0	0.96	0.00	7.90	0.90
4	158.57	0.01	25.6	0.14	0.16	2	0.00	32.0	1.36	0.00	7.81	0.90
5	158.71	0.01	25.6	0.14	0.16	2	0.00	32.0	1.33	0.00	7.68	0.90
6	158.85	0.01	25.5	0.14	0.16	2	0.00	32.0	1.32	0.00	7.60	0.90
7	158.99	0.01	25.5	0.14	0.16	2	0.00	32.0	1.30	0.00	7.47	0.90
8	159.13	0.01	25.5	0.14	0.16	2	0.00	32.0	1.28	0.00	7.39	0.90
9	159.28	0.01	25.5	0.14	0.16	2	0.00	32.0	1.26	0.00	7.26	0.90
10	159.42	0.01	25.4	0.14	0.16	2	0.00	32.0	1.24	0.00	7.13	0.90
11	159.56	0.01	25.4	0.14	0.16	2	0.00	32.0	1.21	0.00	7.00	0.90
12	159.70	0.01	25.3	0.14	0.16	2	0.00	32.0	1.18	0.00	6.83	0.90
13	159.84	0.01	25.4	0.14	0.16	2	0.00	32.0	1.15	0.00	6.65	0.90
14	159.98	0.01	25.3	0.14	0.16	2	0.00	32.0	1.13	0.00	6.53	0.90
15	160.13	0.01	25.3	0.14	0.16	2	0.00	32.0	1.09	0.00	6.31	0.90
16	160.27	0.01	25.3	0.14	0.16	2	0.00	32.0	1.07	0.00	6.18	0.90
17	160.41	0.01	25.3	0.14	0.16	2	0.00	32.0	1.03	0.00	5.96	0.90
18	160.55	0.01	25.2	0.14	0.16	2	0.00	32.0	1.00	0.00	5.79	0.90
19	160.69	0.01	25.2	0.14	0.16	2	0.00	32.0	0.97	0.00	5.57	0.90
20	160.84	0.01	25.2	0.14	0.16	2	0.00	32.0	0.94	0.00	5.40	0.90
21	160.98	0.01	25.1	0.14	0.16	2	0.00	32.0	0.90	0.00	5.19	0.90
22	161.12	0.01	25.1	0.14	0.16	2	0.00	32.0	0.86	0.00	4.97	0.90
23	161.26	0.01	25.1	0.14	0.16	2	0.00	32.0	0.82	0.00	4.75	0.90
24	161.40	0.01	25.1	0.14	0.16	2	0.00	32.0	0.78	0.00	4.49	0.90
25	161.54	0.01	25.1	0.14	0.16	2	0.00	32.0	0.74	0.00	4.27	0.90
26	161.69	0.01	25.0	0.14	0.16	2	0.00	32.0	0.70	0.00	4.01	0.90
27	161.83	0.01	24.9	0.14	0.16	2	0.00	32.0	0.65	0.00	3.75	0.90
28	161.97	0.01	24.9	0.14	0.16	2	0.00	32.0	0.61	0.00	3.49	0.90
29	162.11	0.01	25.0	0.14	0.16	2	0.00	32.0	0.55	0.00	3.18	0.90
30	162.26	0.00	25.0	0.14	0.16	2	0.00	32.0	0.51	0.00	2.97	0.90
31	162.40	0.00	24.9	0.14	0.16	2	0.00	32.0	0.46	0.00	2.66	0.90
32	162.54	0.00	24.9	0.14	0.16	2	0.00	32.0	0.41	0.00	2.36	0.90
33	162.68	0.00	24.7	0.14	0.16	2	0.00	32.0	0.36	0.00	2.10	0.90
34	162.82	0.00	24.8	0.14	0.16	2	0.00	32.0	0.31	0.00	1.79	0.90
35	162.97	0.00	24.8	0.14	0.16	2	0.00	32.0	0.25	0.00	1.44	0.90
36	163.11	0.00	24.7	0.14	0.16	2	0.00	32.0	0.20	0.00	1.14	0.90
37	163.25	0.00	24.7	0.14	0.16	2	0.00	32.0	0.14	0.00	0.83	0.90
38	163.39	0.00	24.8	0.14	0.16	2	0.00	32.0	0.08	0.00	0.48	0.90
39	163.54	0.00	24.7	0.14	0.16	2	0.00	32.0	0.03	0.00	0.17	0.90
		0.00			0.00					0.00		

X-S Area: 0.29 Path Length: 5.96 X-S Weight: 31.09

DATA: Analysis 3 - Active Highwall

Material Properties (2 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and gravel, mixed grain size
Cohesion Phi UnitWeight Ru
0.00 45.0 110.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Mixture of inorganic silts and clays
Cohesion Phi UnitWeight Ru
0.00 32.0 109.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (2 profiles)

Profile: 1 (17 points) Material beneath: 2 - Mixture of inorganic silts and clays
0.00 4956.88 11.06 4957.37 28.11 4957.10 52.01 4956.41
62.85 4954.11
68.36 4953.42 87.23 4953.05 100.72 4953.09 106.98 4950.82
110.43 4953.46
118.08 4954.14 119.80 4954.85 123.30 4955.41 128.76 4954.42
131.54 4953.15
158.47 4953.28 214.69 4954.12
Profile: 2 (10 points) Material beneath: 1 - Sand and gravel, mixed grain size
0.00 4953.88 11.06 4954.37 28.11 4954.10 52.01 4953.41
62.85 4951.11
68.36 4950.42 87.23 4950.05 100.72 4950.09 158.47 4950.28
214.69 4951.12

Slope Surface (20 points)

0.00 4956.88 11.06 4957.37 28.11 4957.10 52.01 4956.41
62.85 4954.11
68.36 4953.42 87.23 4953.05 100.72 4953.09 106.98 4950.82
110.43 4953.46
118.08 4954.14 119.80 4954.85 123.30 4955.41 128.76 4954.42
131.54 4953.15
158.47 4953.28 178.00 4953.20 180.00 4936.00 193.29 4935.88
214.69 4936.00

Piezometric Surfaces (1 surface)

Surface within profile: 2 (4 points) - Sand and gravel, mixed grain size
0.00 4947.00 159.00 4947.00 180.00 4936.00 215.00 4936.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL: 153.30 YL: 4953.25 XR: 179.20 YR: 4942.88
Centre: XC: 296.30 YC: 5272.71 Radius: R: 350.00

Distributed Loads (1 load)

Load	X-Left	Pressure	X-Right	Pressure
1	118.00	818.0	153.00	818.0

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	22.00	14.50	15.00
Trial positions within range:	30	15	15

- -

RESULTS: Analysis 3 - Active Highwall

Bishop Simplified Method of Analysis - Circular Failure Surface
---
Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 2.509

There were: 3576 successful analyses from a total of 6751 trial surfaces

3175 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.41

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	164.30	4953.26	179.20	4942.88	375.98	5241.35	357.50	1.412	<--
Critical Surface									
2	164.30	4953.26	179.20	4942.88	375.37	5240.47	356.43	1.412	
3	164.30	4953.26	179.20	4942.88	374.76	5239.59	355.36	1.412	
4	164.30	4953.26	179.20	4942.88	374.15	5238.71	354.29	1.412	
5	164.30	4953.26	179.20	4942.88	373.53	5237.83	353.21	1.412	
6	164.30	4953.26	179.20	4942.88	372.92	5236.95	352.14	1.413	
7	164.30	4953.26	179.20	4942.88	372.31	5236.07	351.07	1.413	
8	164.30	4953.26	179.20	4942.88	371.70	5235.19	350.00	1.413	
9	164.30	4953.26	179.20	4942.88	371.08	5234.31	348.93	1.413	
10	164.30	4953.26	179.20	4942.88	370.47	5233.43	347.86	1.413	
11	164.30	4953.26	179.20	4942.88	369.86	5232.55	346.79	1.413	
12	164.30	4953.26	179.20	4942.88	369.25	5231.67	345.71	1.413	
13	164.30	4953.26	179.20	4942.88	368.63	5230.79	344.64	1.413	
14	164.30	4953.26	179.20	4942.88	368.02	5229.91	343.57	1.413	
15	164.30	4953.26	179.20	4942.88	367.41	5229.03	342.50	1.413	
16	163.54	4953.26	179.20	4942.88	368.82	5245.95	357.50	1.486	
17	163.54	4953.26	179.20	4942.88	368.23	5245.05	356.43	1.486	
18	163.54	4953.26	179.20	4942.88	367.64	5244.16	355.36	1.486	
19	163.54	4953.26	179.20	4942.88	367.04	5243.27	354.29	1.486	
20	163.54	4953.26	179.20	4942.88	366.45	5242.37	353.21	1.486	
21	163.54	4953.26	179.20	4942.88	365.86	5241.48	352.14	1.486	
22	163.54	4953.26	179.20	4942.88	365.27	5240.59	351.07	1.486	
23	163.54	4953.26	179.20	4942.88	364.68	5239.69	350.00	1.486	
24	163.54	4953.26	179.20	4942.88	364.08	5238.80	348.93	1.486	
25	163.54	4953.26	179.20	4942.88	363.49	5237.91	347.86	1.486	
26	163.54	4953.26	179.20	4942.88	362.90	5237.01	346.79	1.486	
27	163.54	4953.26	179.20	4942.88	362.31	5236.12	345.71	1.487	
28	163.54	4953.26	179.20	4942.88	361.71	5235.23	344.64	1.487	
29	163.54	4953.26	179.20	4942.88	361.12	5234.33	343.57	1.487	
30	163.54	4953.26	179.20	4942.88	360.53	5233.44	342.50	1.487	
31	162.78	4953.26	179.20	4942.88	362.00	5250.11	357.50	1.559	
32	162.78	4953.26	179.20	4942.88	361.43	5249.20	356.43	1.559	
33	162.78	4953.26	179.20	4942.88	360.86	5248.30	355.36	1.560	
34	162.78	4953.26	179.20	4942.88	360.28	5247.39	354.29	1.560	
35	162.78	4953.26	179.20	4942.88	359.71	5246.49	353.21	1.560	
36	162.78	4953.26	179.20	4942.88	359.14	5245.58	352.14	1.560	
37	162.78	4953.26	179.20	4942.88	358.56	5244.67	351.07	1.560	
38	162.78	4953.26	179.20	4942.88	357.99	5243.77	350.00	1.560	
39	162.78	4953.26	179.20	4942.88	357.42	5242.86	348.93	1.560	
40	162.78	4953.26	179.20	4942.88	356.85	5241.96	347.86	1.560	
41	162.78	4953.26	179.20	4942.88	356.27	5241.05	346.79	1.560	
42	162.78	4953.26	179.20	4942.88	355.70	5240.14	345.71	1.560	
43	162.78	4953.26	179.20	4942.88	355.13	5239.24	344.64	1.560	
44	162.78	4953.26	179.20	4942.88	354.55	5238.33	343.57	1.560	
45	162.78	4953.26	179.20	4942.88	353.98	5237.43	342.50	1.561	
46	162.02	4953.27	179.20	4942.88	355.51	5253.88	357.50	1.633	
47	162.02	4953.27	179.20	4942.88	354.96	5252.96	356.43	1.633	
48	162.02	4953.27	179.20	4942.88	354.41	5252.04	355.36	1.633	
49	162.02	4953.27	179.20	4942.88	353.85	5251.13	354.29	1.633	
50	162.02	4953.27	179.20	4942.88	353.30	5250.21	353.21	1.633	
51	162.02	4953.27	179.20	4942.88	352.74	5249.29	352.14	1.634	
52	162.02	4953.27	179.20	4942.88	352.19	5248.37	351.07	1.634	
53	162.02	4953.27	179.20	4942.88	351.63	5247.46	350.00	1.634	
54	162.02	4953.27	179.20	4942.88	351.08	5246.54	348.93	1.634	
55	162.02	4953.27	179.20	4942.88	350.52	5245.62	347.86	1.634	
56	162.02	4953.27	179.20	4942.88	349.97	5244.71	346.79	1.634	
57	162.02	4953.27	179.20	4942.88	349.41	5243.79	345.71	1.634	
58	162.02	4953.27	179.20	4942.88	348.86	5242.87	344.64	1.634	
59	162.02	4953.27	179.20	4942.88	348.30	5241.95	343.57	1.635	
60	162.02	4953.27	179.20	4942.88	347.75	5241.04	342.50	1.635	
61	161.27	4953.27	179.20	4942.88	349.35	5257.29	357.50	1.707	
62	161.27	4953.27	179.20	4942.88	348.81	5256.37	356.43	1.707	
63	161.27	4953.27	179.20	4942.88	348.28	5255.44	355.36	1.707	
64	161.27	4953.27	179.20	4942.88	347.74	5254.51	354.29	1.707	
65	161.27	4953.27	179.20	4942.88	347.20	5253.58	353.21	1.708	
66	161.27	4953.27	179.20	4942.88	346.66	5252.65	352.14	1.708	
67	161.27	4953.27	179.20	4942.88	346.13	5251.73	351.07	1.708	
68	161.27	4953.27	179.20	4942.88	345.59	5250.80	350.00	1.708	
69	161.27	4953.27	179.20	4942.88	345.05	5249.87	348.93	1.708	
70	161.27	4953.27	179.20	4942.88	344.51	5248.94	347.86	1.708	
71	161.27	4953.27	179.20	4942.88	343.98	5248.02	346.79	1.708	
72	161.27	4953.27	179.20	4942.88	343.44	5247.09	345.71	1.708	

73	161.27	4953.27	179.20	4942.88	342.90	5246.16	344.64	1.709
74	161.27	4953.27	179.20	4942.88	342.37	5245.23	343.57	1.709
75	161.27	4953.27	179.20	4942.88	341.83	5244.31	342.50	1.709
76	160.51	4953.27	179.20	4942.88	343.48	5260.40	357.50	1.780
77	160.51	4953.27	179.20	4942.88	342.96	5259.46	356.43	1.780
78	160.51	4953.27	179.20	4942.88	342.43	5258.53	355.36	1.780
79	160.51	4953.27	179.20	4942.88	341.39	5256.65	353.21	1.780
80	160.51	4953.27	179.20	4942.88	341.91	5257.59	354.29	1.780
81	160.51	4953.27	179.20	4942.88	340.87	5255.72	352.14	1.780
82	160.51	4953.27	179.20	4942.88	340.35	5254.78	351.07	1.782
83	160.51	4953.27	179.20	4942.88	339.83	5253.84	350.00	1.782
84	160.51	4953.27	179.20	4942.88	339.31	5252.91	348.93	1.782
85	160.51	4953.27	179.20	4942.88	338.79	5251.97	347.86	1.782
86	160.51	4953.27	179.20	4942.88	338.27	5251.03	346.79	1.783
87	160.51	4953.27	179.20	4942.88	337.75	5250.09	345.71	1.783
88	160.51	4953.27	179.20	4942.88	337.23	5249.16	344.64	1.783
89	160.51	4953.27	179.20	4942.88	336.71	5248.22	343.57	1.783
90	160.51	4953.27	179.20	4942.88	336.19	5247.28	342.50	1.783
91	159.75	4953.27	179.20	4942.88	337.89	5263.23	357.50	1.854
92	159.75	4953.27	179.20	4942.88	337.38	5262.29	356.43	1.854
93	159.75	4953.27	179.20	4942.88	336.87	5261.34	355.36	1.854
94	159.75	4953.27	179.20	4942.88	336.37	5260.40	354.29	1.854
95	159.75	4953.27	179.20	4942.88	335.86	5259.45	353.21	1.854
96	159.75	4953.27	179.20	4942.88	335.36	5258.50	352.14	1.855
97	159.75	4953.27	179.20	4942.88	334.85	5257.56	351.07	1.855
98	159.75	4953.27	179.20	4942.88	334.35	5256.61	350.00	1.855
99	159.75	4953.27	179.20	4942.88	333.84	5255.67	348.93	1.855

Critical Failure Surface (circle 1)

Intersects: XL: 164.30 YL: 4953.26 XR: 179.20 YR: 4942.88
Centre: XC: 375.98 YC: 5241.35 Radius: R: 357.50

Generated failure surface: (20 points)

164.30 4953.26 165.07 4952.69 165.84 4952.13 166.62 4951.57
167.39 4951.01
168.17 4950.45 168.95 4949.90 169.73 4949.35 170.51 4948.79
171.29 4948.25
172.08 4947.70 172.86 4947.16 173.65 4946.61 174.44 4946.07
175.23 4945.54
176.02 4945.00 176.81 4944.47 177.61 4943.94 178.40 4943.41
179.20 4942.88

Slice Geometry and Properties - Critical Failure Surface (circle 1, 39 slices)

Slice	X-S	Base							PoreWater	
Normal Stress	Test X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Factor
1	164.30	0.05	36.2	0.39	0.48	2	0.00	32.0	5.91	0.00	11.58	0.94
2	164.69	0.16	36.3	0.39	0.48	2	0.00	32.0	17.73	0.00	34.72	0.94
3	165.07	0.27	36.1	0.39	0.48	2	0.00	32.0	29.54	0.00	57.84	0.94
4	165.46	0.38	36.1	0.39	0.48	2	0.00	32.0	41.32	0.00	80.91	0.94
5	165.84	0.49	36.0	0.39	0.48	2	0.00	32.0	53.17	0.00	104.02	0.94
6	166.23	0.60	35.9	0.39	0.48	2	0.00	32.0	64.95	0.00	127.12	0.94
7	166.62	0.70	35.8	0.39	0.48	2	0.00	32.0	76.84	0.00	150.26	0.93
8	167.01	0.81	35.8	0.39	0.48	2	0.00	32.0	88.58	0.00	173.22	0.93
9	167.39	0.92	35.6	0.39	0.48	2	0.00	32.0	100.47	0.00	196.39	0.93
10	167.78	1.03	35.6	0.39	0.48	2	0.00	32.0	112.19	0.00	219.31	0.93
11	168.17	1.14	35.5	0.39	0.48	1	0.00	45.0	124.18	0.00	212.04	0.82
12	168.56	1.25	35.5	0.39	0.48	1	0.00	45.0	135.99	0.00	232.21	0.82
13	168.95	1.36	35.3	0.39	0.48	1	0.00	45.0	148.04	0.00	252.94	0.82
14	169.34	1.46	35.3	0.39	0.48	1	0.00	45.0	159.82	0.00	272.90	0.82
15	169.73	1.57	35.1	0.39	0.48	1	0.00	45.0	171.89	0.00	293.67	0.82
16	170.12	1.68	35.2	0.39	0.48	1	0.00	45.0	183.65	0.00	313.56	0.82
17	170.51	1.79	35.0	0.39	0.48	1	0.00	45.0	195.80	0.00	334.25	0.82
18	170.90	1.90	35.0	0.39	0.48	1	0.00	45.0	207.53	0.00	354.49	0.82
19	171.29	2.01	34.8	0.39	0.48	1	0.00	45.0	219.60	0.00	375.12	0.82
20	171.68	2.11	34.8	0.39	0.48	1	0.00	45.0	231.31	0.00	395.13	0.82
21	172.08	2.22	34.7	0.39	0.48	1	0.00	45.0	243.52	0.00	415.91	0.82
22	172.47	2.33	34.7	0.39	0.48	1	0.00	45.0	255.21	0.00	435.62	0.82
23	172.86	2.44	34.5	0.39	0.48	1	0.00	45.0	267.31	0.00	456.84	0.82
24	173.26	2.55	34.5	0.39	0.48	1	0.00	45.0	278.98	0.00	476.50	0.82
25	173.65	2.66	34.4	0.39	0.48	1	0.00	45.0	291.14	0.00	497.25	0.82
26	174.04	2.76	34.4	0.39	0.48	1	0.00	45.0	302.78	0.00	517.12	0.82
27	174.44	2.87	34.3	0.40	0.48	1	0.00	45.0	315.04	0.00	537.97	0.82
28	174.83	2.98	34.2	0.40	0.48	1	0.00	45.0	326.66	0.00	558.15	0.82
29	175.23	3.09	34.1	0.40	0.48	1	0.00	45.0	338.78	0.00	578.91	0.82
30	175.62	3.20	34.1	0.40	0.48	1	0.00	45.0	350.40	0.00	598.40	0.82
31	176.02	3.31	34.0	0.40	0.48	1	0.00	45.0	362.68	0.00	619.27	0.82
32	176.42	3.41	33.9	0.40	0.48	1	0.00	45.0	374.27	0.00	639.44	0.82
33	176.81	3.52	33.8	0.40	0.48	1	0.00	45.0	386.43	0.00	660.26	0.82
34	177.21	3.63	33.8	0.40	0.48	1	0.00	45.0	397.96	0.00	679.97	0.82
35	177.61	3.69	33.6	0.39	0.47	1	0.00	45.0	405.04	0.00	700.89	0.82
36	178.00	2.54	33.7	0.31	0.37	1	0.00	45.0	278.64	0.00	620.66	0.82
37	178.31	0.66	33.6	0.10	0.12	1	0.00	45.0	72.28	0.00	502.52	0.82
38	178.40	1.89	33.5	0.40	0.48	1	0.00	45.0	208.04	0.00	355.47	0.82
39	178.80	0.63	33.5	0.40	0.48	1	0.00	45.0	69.35	0.00	118.50	0.82

```
                --------                    -------                         ----------
     X-S Area:      72.05    Path Length:     18.16              X-S Weight:     7893.03
```

DATA: Analysis 4 - Final Reclamation

Material Properties (2 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and gravel, mixed grain size

Cohesion	Phi	UnitWeight	Ru
0.00	45.0	110.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Mixture of inorganic silts and clays

Cohesion	Phi	UnitWeight	Ru
460.00	32.0	109.00	Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (2 profiles)

Profile: 1 (17 points) Material beneath: 2 - Mixture of inorganic silts and clays

0.00	4956.88	11.06	4957.37	28.11	4957.10	52.01	4956.41	62.85
4954.11								
68.36	4953.42	87.23	4953.05	100.72	4953.09	106.98	4950.82	110.43
4953.46								
118.08	4954.14	119.80	4954.85	123.30	4955.41	128.76	4954.42	131.54
4953.15								
158.47	4953.28	214.69	4954.12					

Profile: 2 (11 points) Material beneath: 1 - Sand and gravel, mixed grain size

0.00	4953.88	11.06	4954.37	28.11	4954.10	52.01	4953.41	62.85
4951.11								
68.36	4950.42	87.23	4950.05	100.72	4950.09	158.47	4950.28	193.00
4936.00								
215.00	4936.00							

Slope Surface (18 points)

0.00	4956.88	11.06	4957.37	28.11	4957.10	52.01	4956.41	62.85
4954.11								
68.36	4953.42	87.23	4953.05	100.72	4953.09	106.98	4950.82	110.43
4953.46								
118.08	4954.14	119.80	4954.85	123.30	4955.41	128.76	4954.42	131.54
4953.15								
158.47	4953.28	210.08	4936.08	214.69	4936.12			

Phreatic Surface (2 points)

0.00	4947.00	215.00	4947.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects:	XL:	158.60	YL:	4953.24	XR:	195.00	YR: 4941.11
Centre:	XC:	223.84	YC:	5088.31	Radius:	R:	150.00

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	20.00	34.80	24.50
Trial positions within range:	30	30	15

```
-  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  -
```

RESULTS: Analysis 4 - Final Reclamation

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 24.387

There were: 12601 successful analyses from a total of 13501 trial surfaces
900 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 5.64

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	148.60	4953.23	210.00	4936.11	215.30	5073.75	137.75	5.641	<-- Critical Surface
2	148.60	4953.23	210.00	4936.11	215.79	5075.49	139.50	5.688	
3	148.60	4953.23	210.00	4936.11	216.27	5077.22	141.25	5.735	
4	148.60	4953.23	208.80	4936.51	214.61	5074.13	137.75	5.765	
5	148.60	4953.23	210.00	4936.11	216.75	5078.95	143.00	5.781	
6	149.29	4953.24	210.00	4936.11	216.05	5073.72	137.75	5.786	
7	148.60	4953.23	208.80	4936.51	215.09	5075.86	139.50	5.813	
8	148.60	4953.23	210.00	4936.11	217.23	5080.68	144.75	5.828	
9	149.29	4953.24	210.00	4936.11	216.54	5075.45	139.50	5.837	
10	148.60	4953.23	208.80	4936.51	215.58	5077.59	141.25	5.861	
11	148.60	4953.23	210.00	4936.11	217.72	5082.40	146.50	5.880	
12	149.29	4953.24	210.00	4936.11	217.03	5077.18	141.25	5.889	
13	148.60	4953.23	207.60	4936.91	213.92	5074.51	137.75	5.892	
14	148.60	4953.23	208.80	4936.51	216.06	5079.32	143.00	5.913	
15	149.29	4953.24	208.80	4936.51	215.37	5074.10	137.75	5.922	
16	148.60	4953.23	210.00	4936.11	218.20	5084.13	148.25	5.922	
17	149.29	4953.24	210.00	4936.11	217.52	5078.91	143.00	5.942	
18	148.60	4953.23	207.60	4936.91	214.40	5076.24	139.50	5.943	
19	148.60	4953.23	208.80	4936.51	216.54	5081.05	144.75	5.958	
20	149.98	4953.24	210.00	4936.11	216.81	5073.69	137.75	5.965	
21	148.60	4953.23	210.00	4936.11	218.68	5085.86	150.00	5.970	
22	149.29	4953.24	208.80	4936.51	215.86	5075.83	139.50	5.976	
23	148.60	4953.23	207.60	4936.91	214.87	5077.97	141.25	5.987	
24	149.29	4953.24	210.00	4936.11	218.00	5080.64	144.75	5.995	
25	148.60	4953.23	208.80	4936.51	217.02	5082.78	146.50	6.008	
26	148.60	4953.23	210.00	4936.11	219.16	5087.58	151.75	6.019	
27	149.98	4953.24	210.00	4936.11	217.31	5075.42	139.50	6.022	
28	149.29	4953.24	208.80	4936.51	216.34	5077.56	141.25	6.030	
29	148.60	4953.23	206.40	4937.31	213.21	5074.89	137.75	6.036	
30	148.60	4953.23	207.60	4936.91	215.35	5079.70	143.00	6.036	
31	149.29	4953.24	210.00	4936.11	218.49	5082.36	146.50	6.048	
32	148.60	4953.23	208.80	4936.51	217.49	5084.50	148.25	6.055	
33	149.29	4953.24	207.60	4936.91	214.68	5074.47	137.75	6.059	
34	148.60	4953.23	210.00	4936.11	219.64	5089.30	153.50	6.067	
35	149.98	4953.24	210.00	4936.11	217.80	5077.14	141.25	6.079	
36	149.29	4953.24	208.80	4936.51	216.83	5079.28	143.00	6.084	
37	148.60	4953.23	207.60	4936.91	215.83	5081.42	144.75	6.085	
38	148.60	4953.23	206.40	4937.31	213.69	5076.62	139.50	6.089	
39	149.29	4953.24	210.00	4936.11	218.98	5084.08	148.25	6.100	
40	148.60	4953.23	208.80	4936.51	217.97	5086.23	150.00	6.102	
41	149.29	4953.24	207.60	4936.91	215.17	5076.20	139.50	6.112	
42	149.98	4953.24	208.80	4936.51	216.14	5074.06	137.75	6.113	
43	148.60	4953.23	210.00	4936.11	220.12	5091.03	155.25	6.115	
44	148.60	4953.23	207.60	4936.91	216.31	5083.15	146.50	6.134	
45	149.98	4953.24	210.00	4936.11	218.29	5078.87	143.00	6.135	
46	149.29	4953.24	208.80	4936.51	217.31	5081.01	144.75	6.135	
47	148.60	4953.23	206.40	4937.31	214.17	5078.34	141.25	6.142	
48	148.60	4953.23	208.80	4936.51	218.45	5087.95	151.75	6.149	
49	149.29	4953.24	210.00	4936.11	219.46	5085.81	150.00	6.151	
50	148.60	4953.23	210.00	4936.11	220.60	5092.75	157.00	6.162	
51	149.29	4953.24	207.60	4936.91	215.65	5077.93	141.25	6.165	
52	149.98	4953.24	208.80	4936.51	216.63	5075.79	139.50	6.172	
53	150.67	4953.24	210.00	4936.11	217.58	5073.65	137.75	6.174	
54	149.29	4953.24	208.80	4936.51	217.80	5082.73	146.50	6.186	
55	148.60	4953.23	205.20	4937.71	212.50	5075.26	137.75	6.187	
56	149.98	4953.24	210.00	4936.11	218.78	5080.59	144.75	6.192	
57	148.60	4953.23	206.40	4937.31	214.64	5080.07	143.00	6.195	
58	148.60	4953.23	208.80	4936.51	218.93	5089.67	153.50	6.196	
59	148.60	4953.23	207.60	4936.91	216.78	5084.87	148.25	6.201	
60	149.29	4953.24	210.00	4936.11	219.95	5087.53	151.75	6.203	
61	148.60	4953.23	210.00	4936.11	221.08	5094.47	158.75	6.208	
62	149.29	4953.24	207.60	4936.91	216.13	5079.65	143.00	6.217	
63	149.29	4953.24	206.40	4937.31	213.99	5074.85	137.75	6.221	
64	149.98	4953.24	208.80	4936.51	217.12	5077.51	141.25	6.227	
65	150.67	4953.24	210.00	4936.11	218.08	5075.37	139.50	6.235	
66	149.29	4953.24	208.80	4936.51	218.28	5084.45	148.25	6.237	
67	148.60	4953.23	205.20	4937.71	212.98	5076.99	139.50	6.242	
68	148.60	4953.23	208.80	4936.51	219.41	5091.39	155.25	6.242	
69	148.60	4953.23	206.40	4937.31	215.12	5081.79	144.75	6.247	
70	149.98	4953.24	210.00	4936.11	219.28	5082.31	146.50	6.248	
71	148.60	4953.23	207.60	4936.91	217.26	5086.60	150.00	6.252	
72	148.60	4953.23	210.00	4936.11	221.56	5096.19	160.50	6.253	
73	149.29	4953.24	210.00	4936.11	220.44	5089.25	153.50	6.254	
74	149.98	4953.24	207.60	4936.91	215.46	5074.43	137.75	6.256	
75	149.29	4953.24	206.40	4937.31	214.47	5076.57	139.50	6.278	
76	149.98	4953.24	208.80	4936.51	217.61	5079.24	143.00	6.282	
77	149.29	4953.24	208.80	4936.51	218.77	5086.18	150.00	6.287	

78	148.60	4953.23	208.80	4936.51	219.89	5093.11	157.00	6.288
79	149.29	4953.24	207.60	4936.91	216.61	5081.38	144.75	6.289
80	148.60	4953.23	205.20	4937.71	213.45	5078.72	141.25	6.295
81	148.60	4953.23	210.00	4936.11	222.04	5097.91	162.25	6.297
82	148.60	4953.23	206.40	4937.31	215.59	5083.52	146.50	6.299
83	148.60	4953.23	207.60	4936.91	217.74	5088.32	151.75	6.302
84	149.29	4953.24	210.00	4936.11	220.92	5090.97	155.25	6.303
85	149.98	4953.24	210.00	4936.11	219.77	5084.03	148.25	6.303
86	149.98	4953.24	207.60	4936.91	215.94	5076.16	139.50	6.312
87	150.67	4953.24	210.00	4936.11	218.58	5077.10	141.25	6.315
88	148.60	4953.23	208.80	4936.51	220.37	5094.83	158.75	6.333
89	149.29	4953.24	206.40	4937.31	214.95	5078.30	141.25	6.334
90	149.29	4953.24	208.80	4936.51	219.25	5087.90	151.75	6.337
91	149.98	4953.24	208.80	4936.51	218.10	5080.96	144.75	6.337
92	149.29	4953.24	207.60	4936.91	217.10	5083.10	146.50	6.343
93	150.67	4953.24	208.80	4936.51	216.91	5074.02	137.75	6.345
94	148.60	4953.23	204.00	4938.11	211.79	5075.64	137.75	6.346
95	148.60	4953.23	205.20	4937.71	213.92	5080.44	143.00	6.349
96	148.60	4953.23	206.40	4937.31	216.07	5085.24	148.25	6.351
97	149.29	4953.24	210.00	4936.11	221.41	5092.69	157.00	6.351
98	148.60	4953.23	207.60	4936.91	218.21	5090.04	153.50	6.352
99	150.67	4953.24	210.00	4936.11	219.08	5078.82	143.00	6.359

Critical Failure Surface (circle 1)

Intersects: XL: 148.60 YL: 4953.23 XR: 210.00 YR: 4936.11
Centre: XC: 215.30 YC: 5073.75 Radius: R: 137.75

Generated failure surface: (20 points)

148.60 4953.23 151.58 4951.63 154.60 4950.10 157.66 4948.65
160.75 4947.27
163.88 4945.96 167.03 4944.74 170.22 4943.59 173.43 4942.52
176.67 4941.53
179.93 4940.62 183.21 4939.80 186.51 4939.05 189.83 4938.38
193.17 4937.80
196.52 4937.29 199.87 4936.87 203.24 4936.53 206.62 4936.28
210.00 4936.11

Slice Geometry and Properties - Critical Failure Surface (circle 1, 42 slices)

Slice	X-S	Base						PoreWater	Normal	Test
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	148.60	0.60	28.3	1.49	1.69	2	460.00	32.0	65.71	0.00	0.21	1.07
2	150.09	1.81	28.3	1.49	1.69	2	460.00	32.0	197.13	0.00	83.42	1.07
3	151.58	2.64	26.8	1.35	1.51	2	460.00	32.0	287.95	0.00	163.37	1.06
4	152.93	3.57	26.8	1.35	1.51	2	460.00	32.0	388.95	0.00	234.38	1.06
5	154.28	1.01	26.9	0.33	0.37	1	0.00	45.0	109.64	0.00	307.85	1.03
6	154.60	5.39	25.5	1.53	1.69	1	0.00	45.0	588.62	0.00	355.11	1.02
7	156.13	6.52	25.4	1.53	1.69	1	0.00	45.0	712.10	0.00	429.62	1.02
8	157.66	3.90	24.0	0.81	0.89	1	0.00	45.0	426.45	0.00	487.81	1.01
9	158.47	5.77	24.0	1.14	1.25	1	0.00	45.0	631.50	0.00	512.96	1.01
10	159.61	5.92	24.0	1.14	1.25	1	0.00	45.0	647.51	0.00	525.96	1.01
11	160.75	3.38	22.6	0.64	0.69	1	0.00	45.0	370.11	0.00	537.74	1.01
12	161.39	6.65	22.6	1.24	1.35	1	0.00	45.0	727.87	21.73	546.83	1.01
13	162.63	6.78	22.6	1.24	1.35	1	0.00	45.0	741.96	65.19	559.61	1.01
14	163.88	8.77	21.2	1.58	1.69	1	0.00	45.0	958.92	141.68	573.93	1.00
15	165.45	8.90	21.2	1.58	1.69	1	0.00	45.0	973.80	206.39	585.24	1.00
16	167.03	9.09	19.8	1.59	1.69	1	0.00	45.0	993.99	269.08	596.21	1.00
17	168.63	9.16	19.8	1.59	1.69	1	0.00	45.0	1001.23	329.63	602.63	1.00
18	170.22	9.27	18.4	1.61	1.69	1	0.00	45.0	1013.36	388.15	608.55	1.00
19	171.82	9.27	18.4	1.61	1.69	1	0.00	45.0	1012.99	444.66	610.17	1.00
20	173.43	9.31	17.0	1.62	1.69	1	0.00	45.0	1016.68	498.94	610.90	0.99
21	175.05	9.23	17.0	1.62	1.69	1	0.00	45.0	1008.56	551.24	607.72	0.99
22	176.67	3.65	15.6	0.65	0.67	1	0.00	45.0	399.03	232.23	605.63	0.99
23	177.31	7.34	15.6	1.31	1.36	1	0.00	45.0	801.19	493.80	613.80	0.99
24	178.62	7.24	15.6	1.31	1.36	1	0.00	45.0	790.80	524.71	633.22	0.99
25	179.93	8.92	14.2	1.64	1.69	1	0.00	45.0	973.88	695.35	653.95	0.99
26	181.57	8.71	14.2	1.64	1.69	1	0.00	45.0	949.60	739.09	673.59	0.99
27	183.21	6.98	12.8	1.35	1.38	1	0.00	45.0	760.81	635.84	690.68	0.99
28	184.56	9.74	12.8	1.95	2.00	2	460.00	32.0	1061.37	965.12	691.30	1.00
29	186.51	7.93	11.4	1.66	1.69	2	460.00	32.0	864.03	857.62	708.34	1.00
30	188.17	7.56	11.4	1.66	1.69	2	460.00	32.0	824.46	892.90	719.21	1.00
31	189.83	7.20	9.9	1.67	1.69	2	460.00	32.0	784.26	925.89	730.21	1.00
32	191.50	6.76	9.9	1.67	1.69	2	460.00	32.0	736.51	956.82	736.48	1.00
33	193.17	6.31	8.5	1.67	1.69	2	460.00	32.0	687.45	985.52	742.84	0.99
34	194.84	5.80	8.5	1.67	1.69	2	460.00	32.0	631.68	1012.14	744.55	0.99
35	196.52	5.26	7.1	1.68	1.69	2	460.00	32.0	573.64	1036.48	746.24	0.99
36	198.19	4.68	7.1	1.68	1.69	2	460.00	32.0	509.82	1058.76	743.37	0.99
37	199.87	4.07	5.7	1.68	1.69	2	460.00	32.0	443.11	1078.78	740.43	0.99
38	201.56	3.40	5.7	1.68	1.69	2	460.00	32.0	371.04	1096.63	732.88	0.99
39	203.24	2.71	4.3	1.69	1.69	2	460.00	32.0	295.66	1112.25	725.22	0.99
40	204.93	1.98	4.3	1.69	1.69	2	460.00	32.0	215.70	1125.76	713.11	0.99
41	206.62	1.21	2.9	1.69	1.69	2	460.00	32.0	131.90	1136.97	700.73	1.00
42	208.31	0.40	2.9	1.69	1.69	2	460.00	32.0	44.00	1146.05	683.99	1.00
		244.79			64.32				26724.93			

X-S Area: 244.79 Path Length: 64.32 X-S Weight: 26724.93

DATA: Analysis 5 - Final Reclamation

Material Properties (2 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and gravel, mixed grain size
   Cohesion   Phi   UnitWeight   Ru
      0.00   45.0   110.00   Auto
Material: 2 (Mohr-Coulomb Isotropic) - Mixture of inorganic silts and clays
   Cohesion   Phi   UnitWeight   Ru
    460.00   32.0   109.00   Auto

Water Properties

Unit weight of water: 62.400   Unit weight of water/medium above ground: 62.400

Material Profiles (2 profiles)

Profile: 1 (17 points)   Material beneath: 2 - Mixture of inorganic silts and clays
      0.00   4956.88   11.06   4957.37   28.11   4957.10   52.01   4956.41
62.85   4954.11
     68.36   4953.42   87.23   4953.05   100.72   4953.09   106.98   4950.82
110.43   4953.46
    118.08   4954.14   119.80   4954.85   123.30   4955.41   128.76   4954.42
131.54   4953.15
    158.47   4953.28   214.69   4954.12
Profile: 2 (11 points)   Material beneath: 1 - Sand and gravel, mixed grain size
      0.00   4953.88   11.06   4954.37   28.11   4954.10   52.01   4953.41
62.85   4951.11
     68.36   4950.42   87.23   4950.05   100.72   4950.09   158.47   4950.28
193.00   4936.00
    215.00   4936.00

Slope Surface (18 points)

      0.00   4956.88   11.06   4957.37   28.11   4957.10   52.01   4956.41
62.85   4954.11
     68.36   4953.42   87.23   4953.05   100.72   4953.09   106.98   4950.82
110.43   4953.46
    118.08   4954.14   119.80   4954.85   123.30   4955.41   128.76   4954.42
131.54   4953.15
    158.47   4953.28   210.08   4936.08   214.69   4936.12

Phreatic Surface (2 points)

      0.00   4947.00   215.00   4947.00

Failure Surface (Critical, from previous analysis)

Initial circular surface for critical search defined by: XL,XR,R
  Intersects: XL: 148.60   YL: 4953.23   XR: 210.00   YR: 4936.11
      Centre: XC: 215.30   YC: 5073.75   Radius: R: 137.75

Variable Restraints

Parameter descriptor: XL   XR   R
Range of variation: 20.00   34.80   24.50
Trial positions within range: 30   30   15

- -

RESULTS: Analysis 5 - Final Reclamation

Bishop Simplified Method of Analysis - Circular Failure Surface
---
Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 5.641

There were: 7118 successful analyses from a total of 13501 trial surfaces
            6383 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 3.83

Negative normal stresses exist on the base of one or more slices; examine slice data and consult the GALENA Help utility

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	138.60	4953.18	214.20	4936.12	202.69	5061.09	125.50	3.830	<-- Critical Surface
2	139.29	4953.19	214.20	4936.12	203.29	5061.14	125.50	3.855	
3	138.60	4953.18	214.20	4936.12	203.09	5062.88	127.25	3.869	
4	138.60	4953.18	213.00	4936.11	202.55	5061.17	125.50	3.883	
5	139.29	4953.19	213.00	4936.11	203.16	5061.22	125.50	3.936	
6	139.98	4953.19	214.20	4936.12	203.90	5061.19	125.50	3.938	
7	139.29	4953.19	214.20	4936.12	203.70	5062.93	127.25	3.939	
8	138.60	4953.18	211.80	4936.10	202.42	5061.24	125.50	3.942	
9	138.60	4953.18	214.20	4936.12	203.50	5064.67	129.00	3.942	
10	138.60	4953.18	213.00	4936.11	202.96	5062.96	127.25	3.944	
11	139.29	4953.19	211.80	4936.10	203.04	5061.29	125.50	3.993	
12	138.60	4953.18	211.80	4936.10	202.84	5063.03	127.25	3.999	
13	138.60	4953.18	210.60	4936.08	202.31	5061.31	125.50	4.000	
14	139.98	4953.19	213.00	4936.11	203.78	5061.27	125.50	4.003	
15	139.29	4953.19	213.00	4936.11	203.57	5063.01	127.25	4.005	
16	138.60	4953.18	213.00	4936.11	203.37	5064.75	129.00	4.009	
17	139.98	4953.19	214.20	4936.12	204.31	5062.98	127.25	4.013	
18	139.29	4953.19	214.20	4936.12	204.11	5064.72	129.00	4.014	
19	140.67	4953.19	214.20	4936.12	204.51	5061.24	125.50	4.014	
20	138.60	4953.18	214.20	4936.12	203.90	5066.46	130.75	4.015	
21	139.98	4953.19	213.00	4936.11	204.19	5063.05	127.25	4.069	
22	139.29	4953.19	213.00	4936.11	203.99	5064.79	129.00	4.073	
23	138.60	4953.18	213.00	4936.11	203.78	5066.53	130.75	4.075	
24	138.60	4953.18	211.80	4936.10	203.25	5064.81	129.00	4.076	
25	139.29	4953.19	210.60	4936.08	202.94	5061.35	125.50	4.077	
26	139.29	4953.19	211.80	4936.10	203.46	5063.07	127.25	4.078	
27	138.60	4953.18	210.60	4936.08	202.73	5063.09	127.25	4.079	
28	139.98	4953.19	211.80	4936.10	203.66	5061.33	125.50	4.081	
29	140.67	4953.19	213.00	4936.11	204.40	5061.31	125.50	4.083	
30	139.29	4953.19	214.20	4936.12	204.52	5066.51	130.75	4.086	
31	138.60	4953.18	214.20	4936.12	204.30	5068.25	132.50	4.086	
32	139.98	4953.19	214.20	4936.12	204.72	5064.77	129.00	4.087	
33	140.67	4953.19	214.20	4936.12	204.93	5063.03	127.25	4.089	
34	141.36	4953.20	214.20	4936.12	205.13	5061.29	125.50	4.093	
35	138.60	4953.18	213.00	4936.11	204.19	5068.31	132.50	4.153	
36	139.29	4953.19	210.60	4936.08	203.36	5063.13	127.25	4.153	
37	139.98	4953.19	210.60	4936.08	203.57	5061.39	125.50	4.154	
38	138.60	4953.18	210.60	4936.08	203.16	5064.87	129.00	4.154	
39	138.60	4953.18	214.20	4936.12	204.71	5070.03	134.25	4.156	
40	139.29	4953.19	214.20	4936.12	204.92	5068.29	132.50	4.157	
41	139.98	4953.19	214.20	4936.12	205.13	5066.55	130.75	4.159	
42	138.60	4953.18	211.80	4936.10	203.67	5066.59	130.75	4.159	
43	139.29	4953.19	213.00	4936.11	204.40	5066.57	130.75	4.160	
44	139.98	4953.19	211.80	4936.10	204.09	5063.11	127.25	4.166	
45	139.29	4953.19	211.80	4936.10	203.88	5064.85	129.00	4.167	
46	139.98	4953.19	213.00	4936.11	204.61	5064.83	129.00	4.169	
47	140.67	4953.19	214.20	4936.12	205.34	5064.81	129.00	4.172	
48	140.67	4953.19	211.80	4936.10	204.29	5061.37	125.50	4.173	
49	140.67	4953.19	213.00	4936.11	204.82	5063.09	127.25	4.179	
50	141.36	4953.20	214.20	4936.12	205.55	5063.07	127.25	4.186	
51	141.36	4953.20	213.00	4936.11	205.02	5061.35	125.50	4.189	
52	142.05	4953.20	214.20	4936.12	205.75	5061.33	125.50	4.203	
53	138.60	4953.18	210.60	4936.08	203.58	5066.65	130.75	4.225	
54	139.29	4953.19	210.60	4936.08	203.79	5064.90	129.00	4.228	
55	138.60	4953.18	214.20	4936.12	205.11	5071.81	136.00	4.232	
56	138.60	4953.18	213.00	4936.11	204.60	5070.09	134.25	4.241	
57	139.29	4953.19	211.80	4936.10	204.30	5066.63	130.75	4.242	
58	139.29	4953.19	214.20	4936.12	205.33	5070.07	134.25	4.244	
59	139.98	4953.19	210.60	4936.08	204.00	5063.16	127.25	4.244	
60	138.60	4953.18	211.80	4936.10	204.09	5068.37	132.50	4.247	
61	139.98	4953.19	211.80	4936.10	204.51	5064.89	129.00	4.248	
62	139.29	4953.19	213.00	4936.11	204.81	5068.35	132.50	4.249	
63	140.67	4953.19	211.80	4936.10	204.72	5063.15	127.25	4.255	
64	139.98	4953.19	214.20	4936.12	205.54	5068.33	132.50	4.256	
65	139.98	4953.19	213.00	4936.11	205.03	5066.61	130.75	4.258	
66	141.36	4953.20	211.80	4936.10	204.93	5061.41	125.50	4.264	
67	140.67	4953.19	213.00	4936.11	205.24	5064.87	129.00	4.268	
68	140.67	4953.19	214.20	4936.12	205.76	5066.59	130.75	4.271	
69	140.67	4953.19	210.60	4936.08	204.21	5061.42	125.50	4.275	
70	141.36	4953.20	213.00	4936.11	205.45	5063.13	127.25	4.281	
71	141.36	4953.20	214.20	4936.12	205.97	5064.85	129.00	4.286	
72	142.05	4953.20	213.00	4936.11	205.65	5061.39	125.50	4.295	
73	142.05	4953.20	214.20	4936.12	206.17	5063.11	127.25	4.303	
74	138.60	4953.18	211.80	4936.10	204.50	5070.15	134.25	4.314	
75	139.29	4953.19	211.80	4936.10	204.72	5068.41	132.50	4.320	
76	142.74	4953.20	214.20	4936.12	206.38	5061.37	125.50	4.322	
77	138.60	4953.18	213.00	4936.11	205.00	5071.87	136.00	4.323	

78	138.60	4953.18	214.20	4936.12	205.51	5073.59	137.75	4.324
79	138.60	4953.18	210.60	4936.08	204.00	5068.42	132.50	4.324
80	139.29	4953.19	213.00	4936.11	205.23	5070.13	134.25	4.334
81	139.29	4953.19	214.20	4936.12	205.73	5071.85	136.00	4.337
82	139.98	4953.19	211.80	4936.10	204.93	5066.67	130.75	4.340
83	139.29	4953.19	210.60	4936.08	204.22	5066.68	130.75	4.341
84	139.98	4953.19	213.00	4936.11	205.44	5068.39	132.50	4.343
85	139.98	4953.19	214.20	4936.12	205.95	5070.11	134.25	4.350
86	140.67	4953.19	213.00	4936.11	205.66	5066.65	130.75	4.355
87	139.98	4953.19	210.60	4936.08	204.43	5064.94	129.00	4.358
88	140.67	4953.19	211.80	4936.10	205.15	5064.92	129.00	4.365
89	140.67	4953.19	214.20	4936.12	206.17	5068.37	132.50	4.365
90	141.36	4953.20	213.00	4936.11	205.87	5064.91	129.00	4.369
91	140.67	4953.19	210.60	4936.08	204.64	5063.19	127.25	4.377
92	141.36	4953.20	214.20	4936.12	206.38	5066.63	130.75	4.382
93	141.36	4953.20	211.80	4936.10	205.36	5063.18	127.25	4.392
94	141.36	4953.20	210.60	4936.08	204.85	5061.45	125.50	4.393
95	142.05	4953.20	214.20	4936.12	206.59	5064.89	129.00	4.400
96	138.60	4953.18	213.00	4936.11	205.41	5073.65	137.75	4.405
97	142.05	4953.20	213.00	4936.11	206.08	5063.17	127.25	4.409
98	138.60	4953.18	214.20	4936.12	205.91	5075.37	139.50	4.411
99	138.60	4953.18	211.80	4936.10	204.91	5071.92	136.00	4.412

Critical Failure Surface (circle 1)

Intersects: XL: 138.60 YL: 4953.18 XR: 214.20 YR: 4936.12
Centre: XC: 202.69 YC: 5061.09 Radius: R: 125.50

Generated failure surface: (20 points)

138.60 4953.18 142.20 4951.13 145.87 4949.19 149.59 4947.37
153.38 4945.68
157.22 4944.11 161.11 4942.67 165.04 4941.37 169.02 4940.19
173.03 4939.14
177.08 4938.23 181.15 4937.45 185.24 4936.80 189.36 4936.30
193.49 4935.92
197.63 4935.69 201.78 4935.59 205.92 4935.63 210.07 4935.80
214.20 4936.12

Slice Geometry and Properties - Critical Failure Surface (circle 1, 42 slices)

Slice	X-S	Base						PoreWater	Normal	Test
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	138.60	0.93	29.8	1.80	2.07	2	460.00	32.0	101.83	0.00	-11.07	1.05
2	140.40	2.80	29.8	1.80	2.07	2	460.00	32.0	305.39	0.00	92.37	1.05
3	142.20	4.27	27.9	1.69	1.91	2	460.00	32.0	465.46	0.00	195.10	1.04
4	143.89	6.92	27.9	1.98	2.24	1	0.00	45.0	755.86	0.00	336.14	0.99
5	145.87	8.37	26.0	1.86	2.07	1	0.00	45.0	915.17	0.00	435.61	0.99
6	147.73	10.08	26.0	1.86	2.07	1	0.00	45.0	1103.08	0.00	525.02	0.99
7	149.59	5.03	24.1	0.83	0.91	1	0.00	45.0	550.41	0.00	593.61	0.98
8	150.42	9.72	24.1	1.48	1.62	1	0.00	45.0	1064.28	33.34	647.10	0.98
9	151.90	10.70	24.1	1.48	1.62	1	0.00	45.0	1172.77	100.05	717.21	0.98
10	153.38	15.30	22.2	1.92	2.07	1	0.00	45.0	1677.80	221.53	800.15	0.98
11	155.30	16.83	22.2	1.92	2.07	1	0.00	45.0	1845.06	322.82	883.54	0.98
12	157.22	11.76	20.3	1.25	1.33	1	0.00	45.0	1289.47	259.61	956.84	0.97
13	158.47	12.73	20.3	1.32	1.41	1	0.00	45.0	1396.52	315.31	985.32	0.97
14	159.79	12.80	20.3	1.32	1.41	1	0.00	45.0	1403.40	358.12	992.76	0.97
15	161.11	19.13	18.4	1.97	2.07	1	0.00	45.0	2098.08	601.88	1004.46	0.97
16	163.08	19.13	18.4	1.97	2.07	1	0.00	45.0	2097.58	686.65	1007.44	0.97
17	165.04	19.26	16.5	1.99	2.07	1	0.00	45.0	2111.05	767.00	1012.29	0.97
18	167.03	19.11	16.5	1.99	2.07	1	0.00	45.0	2094.73	843.31	1007.26	0.97
19	169.02	19.07	14.6	2.01	2.07	1	0.00	45.0	2089.63	915.27	1003.28	0.97
20	171.02	18.78	14.6	2.01	2.07	1	0.00	45.0	2057.19	982.87	990.26	0.97
21	173.03	18.56	12.7	2.02	2.07	1	0.00	45.0	2033.13	1046.30	977.44	0.97
22	175.05	18.12	12.7	2.02	2.07	1	0.00	45.0	1984.36	1105.42	956.22	0.97
23	177.08	17.73	10.8	2.04	2.07	1	0.00	45.0	1941.12	1160.17	949.94	0.97
24	179.11	17.14	10.8	2.04	2.07	1	0.00	45.0	1875.92	1210.46	960.96	0.97
25	181.15	16.58	8.9	2.05	2.07	1	0.00	45.0	1813.27	1256.58	971.36	0.97
26	183.20	15.84	8.9	2.05	2.07	1	0.00	45.0	1731.73	1298.16	974.83	0.97
27	185.24	15.10	7.0	2.06	2.07	1	0.00	45.0	1649.71	1335.48	977.31	0.98
28	187.30	14.21	7.0	2.06	2.07	1	0.00	45.0	1551.89	1368.46	973.20	0.98
29	189.36	11.77	5.2	1.82	1.83	1	0.00	45.0	1284.75	1229.84	968.44	0.98
30	191.18	10.97	5.2	1.82	1.83	1	0.00	45.0	1195.91	1248.54	957.96	0.98
31	193.00	2.82	5.1	0.49	0.49	1	0.00	45.0	306.99	339.51	951.41	0.98
32	193.49	11.18	3.3	2.07	2.07	1	0.00	45.0	1218.44	1440.65	942.88	0.99
33	195.56	9.99	3.3	2.07	2.07	1	0.00	45.0	1089.67	1455.86	924.09	0.99
34	197.63	8.75	1.4	2.07	2.07	1	0.00	45.0	954.05	1466.59	903.12	0.99
35	199.70	7.42	1.4	2.07	2.07	1	0.00	45.0	809.30	1473.03	876.59	0.99
36	201.78	6.02	-0.5	2.07	2.07	1	0.00	45.0	656.83	1475.01	847.41	1.00
37	203.85	4.55	-0.5	2.07	2.07	1	0.00	45.0	496.24	1472.48	812.99	1.00
38	205.92	3.00	-2.4	2.07	2.07	1	0.00	45.0	327.79	1465.61	775.47	1.01
39	207.99	1.39	-2.4	2.07	2.07	1	0.00	45.0	151.98	1454.28	733.28	1.01
40	210.07	0.30	-4.3	1.30	1.31	1	0.00	45.0	33.24	908.12	706.82	1.02
41	211.37	0.19	-4.3	1.30	1.31	1	0.00	45.0	20.78	900.15	696.47	1.02
42	212.67	0.08	-4.3	1.53	1.54	2	460.00	32.0	8.64	1048.47	694.44	1.02
		454.40			78.79				49730.52			

X-S Area: 454.40 Path Length: 78.79 X-S Weight: 49730.52

DATA: Analysis 6 - Final Reclamation

Material Properties (2 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and gravel, mixed grain size
   Cohesion   Phi   UnitWeight   Ru
      0.00   45.0   110.00   Auto
Material: 2 (Mohr-Coulomb Isotropic) - Mixture of inorganic silts and clays
   Cohesion   Phi   UnitWeight   Ru
    460.00   32.0   109.00   Auto

Water Properties

Unit weight of water: 62.400   Unit weight of water/medium above ground: 62.400

Material Profiles (2 profiles)

Profile: 1 (17 points)   Material beneath: 2 - Mixture of inorganic silts and clays
      0.00   4956.88   11.06   4957.37   28.11   4957.10   52.01   4956.41
62.85   4954.11
     68.36   4953.42   87.23   4953.05   100.72   4953.09   106.98   4950.82
110.43   4953.46
    118.08   4954.14   119.80   4954.85   123.30   4955.41   128.76   4954.42
131.54   4953.15
    158.47   4953.28   214.69   4954.12
Profile: 2 (11 points)   Material beneath: 1 - Sand and gravel, mixed grain size
      0.00   4953.88   11.06   4954.37   28.11   4954.10   52.01   4953.41
62.85   4951.11
     68.36   4950.42   87.23   4950.05   100.72   4950.09   158.47   4950.28
193.00   4936.00
    215.00   4936.00

Slope Surface (18 points)

      0.00   4956.88   11.06   4957.37   28.11   4957.10   52.01   4956.41
62.85   4954.11
     68.36   4953.42   87.23   4953.05   100.72   4953.09   106.98   4950.82
110.43   4953.46
    118.08   4954.14   119.80   4954.85   123.30   4955.41   128.76   4954.42
131.54   4953.15
    158.47   4953.28   210.08   4936.08   214.69   4936.12

Phreatic Surface (2 points)

      0.00   4947.00   215.00   4947.00

Failure Surface (Critical, from previous analysis)

Initial circular surface for critical search defined by: XL,XR,R
  Intersects: XL: 138.60   YL: 4953.18   XR: 214.20   YR: 4936.12
      Centre: XC: 202.69   YC: 5061.09   Radius: R: 125.50

Variable Restraints

Parameter descriptor: XL   XR   R
Range of variation: 20.00   34.80   24.50
Trial positions within range: 30   30   15

- -
-- -- -- -- -- -

RESULTS: Analysis 6 - Final Reclamation

Bishop Simplified Method of Analysis - Circular Failure Surface
---
Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 3.830

There were: 6546 successful analyses from a total of 13501 trial surfaces
            6955 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 3.66

Negative normal stresses exist on the base of one or more slices; examine slice data and consult the GALENA
Help utility

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	141.70	4953.20	213.60	4936.11	202.41	5048.81	113.25	3.657	<-- Critical Surface
2	141.01	4953.20	213.60	4936.11	201.81	5048.75	113.25	3.674	
3	141.01	4953.20	212.40	4936.10	201.66	5048.84	113.25	3.680	
4	141.70	4953.20	212.40	4936.10	202.26	5048.90	113.25	3.687	
5	141.01	4953.20	211.20	4936.09	201.52	5048.93	113.25	3.687	
6	141.01	4953.20	213.60	4936.11	202.23	5050.55	115.00	3.688	
7	142.39	4953.20	213.60	4936.11	203.01	5048.86	113.25	3.689	
8	140.32	4953.19	213.60	4936.11	201.21	5048.68	113.25	3.692	
9	141.01	4953.20	212.40	4936.10	202.09	5050.64	115.00	3.694	
10	141.70	4953.20	213.60	4936.11	202.83	5050.61	115.00	3.697	
11	140.32	4953.19	212.40	4936.10	201.06	5048.78	113.25	3.698	
12	141.01	4953.20	213.60	4936.11	202.66	5052.35	116.75	3.703	
13	140.32	4953.19	211.20	4936.09	200.91	5048.87	113.25	3.705	
14	140.32	4953.19	213.60	4936.11	201.63	5050.49	115.00	3.705	
15	140.32	4953.19	212.40	4936.10	201.48	5050.58	115.00	3.712	
16	139.63	4953.19	213.60	4936.11	200.62	5048.61	113.25	3.712	
17	139.63	4953.19	212.40	4936.10	200.46	5048.72	113.25	3.718	
18	140.32	4953.19	211.20	4936.09	201.35	5050.67	115.00	3.719	
19	140.32	4953.19	213.60	4936.11	202.05	5052.29	116.75	3.719	
20	139.63	4953.19	211.20	4936.09	200.31	5048.81	113.25	3.724	
21	139.63	4953.19	213.60	4936.11	201.04	5050.42	115.00	3.725	
22	140.32	4953.19	212.40	4936.10	201.91	5052.38	116.75	3.726	
23	139.63	4953.19	212.40	4936.10	200.88	5050.52	115.00	3.731	
24	138.94	4953.19	213.60	4936.11	200.04	5048.55	113.25	3.733	
25	140.32	4953.19	213.60	4936.11	202.47	5054.09	118.50	3.733	
26	139.63	4953.19	211.20	4936.09	200.74	5050.61	115.00	3.737	
27	139.63	4953.19	213.60	4936.11	201.46	5052.23	116.75	3.738	
28	140.32	4953.19	210.00	4936.11	200.74	5048.98	113.25	3.738	
29	138.94	4953.19	212.40	4936.10	199.87	5048.65	113.25	3.739	
30	139.63	4953.19	212.40	4936.10	201.31	5052.32	116.75	3.744	
31	138.94	4953.19	213.60	4936.11	200.45	5050.36	115.00	3.745	
32	138.94	4953.19	211.20	4936.09	199.71	5048.76	113.25	3.748	
33	139.63	4953.19	211.20	4936.09	201.17	5052.41	116.75	3.751	
34	138.94	4953.19	212.40	4936.10	200.29	5050.46	115.00	3.751	
35	139.63	4953.19	213.60	4936.11	201.87	5054.03	118.50	3.751	
36	139.63	4953.19	210.00	4936.11	200.13	5048.93	113.25	3.755	
37	138.26	4953.18	213.60	4936.11	199.45	5048.47	113.25	3.755	
38	138.94	4953.19	213.60	4936.11	200.86	5052.16	116.75	3.757	
39	138.94	4953.19	211.20	4936.09	200.13	5050.56	115.00	3.757	
40	139.63	4953.19	212.40	4936.10	201.73	5054.12	118.50	3.757	
41	141.70	4953.20	211.20	4936.09	202.14	5048.98	113.25	3.759	
42	138.26	4953.18	212.40	4936.10	199.28	5048.59	113.25	3.761	
43	141.01	4953.20	213.60	4936.11	203.08	5054.14	118.50	3.761	
44	142.39	4953.20	212.40	4936.10	202.88	5048.95	113.25	3.762	
45	138.94	4953.19	212.40	4936.10	200.70	5052.26	116.75	3.763	
46	139.63	4953.19	213.60	4936.11	202.29	5055.83	120.25	3.765	
47	141.70	4953.20	212.40	4936.10	202.70	5050.69	115.00	3.766	
48	138.26	4953.18	213.60	4936.11	199.86	5050.29	115.00	3.767	
49	141.01	4953.20	211.20	4936.09	201.96	5050.72	115.00	3.767	
50	143.08	4953.21	213.60	4936.11	203.62	5048.92	113.25	3.768	
51	142.39	4953.20	213.60	4936.11	203.44	5050.66	115.00	3.769	
52	139.63	4953.19	210.00	4936.11	200.57	5050.72	115.00	3.770	
53	138.94	4953.19	213.60	4936.11	201.28	5053.97	118.50	3.770	
54	138.94	4953.19	211.20	4936.09	200.56	5052.35	116.75	3.770	
55	141.70	4953.20	213.60	4936.11	203.26	5052.40	116.75	3.771	
56	138.26	4953.18	212.40	4936.10	199.69	5050.40	115.00	3.772	
57	141.01	4953.20	212.40	4936.10	202.52	5052.43	116.75	3.773	
58	138.94	4953.19	210.00	4936.11	199.52	5048.87	113.25	3.773	
59	138.26	4953.18	211.20	4936.09	199.11	5048.69	113.25	3.774	
60	138.94	4953.19	212.40	4936.10	201.12	5054.06	118.50	3.776	
61	140.32	4953.19	211.20	4936.09	201.78	5052.46	116.75	3.777	
62	140.32	4953.19	213.60	4936.11	202.89	5055.88	120.25	3.778	
63	138.26	4953.18	213.60	4936.11	200.27	5052.10	116.75	3.778	
64	137.57	4953.18	213.60	4936.11	198.87	5048.40	113.25	3.778	
65	138.26	4953.18	211.20	4936.09	199.53	5050.50	115.00	3.782	
66	138.94	4953.19	211.20	4936.09	200.98	5054.15	118.50	3.783	
67	138.94	4953.19	213.60	4936.11	201.69	5055.77	120.25	3.783	
68	138.26	4953.18	212.40	4936.10	200.11	5052.20	116.75	3.784	
69	137.57	4953.18	212.40	4936.10	198.69	5048.52	113.25	3.784	
70	139.63	4953.19	211.20	4936.09	201.59	5054.20	118.50	3.787	
71	138.94	4953.19	210.00	4936.11	199.96	5050.67	115.00	3.787	
72	139.63	4953.19	212.40	4936.10	202.15	5055.91	120.25	3.788	
73	137.57	4953.18	213.60	4936.11	199.28	5050.22	115.00	3.789	
74	138.94	4953.19	212.40	4936.10	201.54	5055.86	120.25	3.790	
75	138.26	4953.18	213.60	4936.11	200.68	5053.90	118.50	3.790	
76	138.26	4953.18	211.20	4936.09	199.95	5052.30	116.75	3.791	
77	140.32	4953.19	212.40	4936.10	202.34	5054.17	118.50	3.792	

78	138.26	4953.18	210.00	4936.11	198.92	5048.81	113.25	3.794
79	137.57	4953.18	212.40	4936.10	199.10	5050.33	115.00	3.795
80	139.63	4953.19	213.60	4936.11	202.70	5057.62	122.00	3.796
81	138.26	4953.18	212.40	4936.10	200.52	5054.00	118.50	3.796
82	138.94	4953.19	213.60	4936.11	202.10	5057.57	122.00	3.797
83	138.94	4953.19	211.20	4936.09	201.41	5055.94	120.25	3.797
84	137.57	4953.18	211.20	4936.09	198.52	5048.63	113.25	3.800
85	137.57	4953.18	213.60	4936.11	199.69	5052.03	116.75	3.801
86	138.94	4953.19	210.00	4936.11	200.39	5052.46	116.75	3.802
87	141.01	4953.20	210.00	4936.11	201.36	5049.03	113.25	3.802
88	136.88	4953.18	213.60	4936.11	198.30	5048.32	113.25	3.802
89	138.26	4953.18	213.60	4936.11	201.09	5055.71	120.25	3.803
90	138.26	4953.18	211.20	4936.09	200.38	5054.09	118.50	3.803
91	138.94	4953.19	212.40	4936.10	201.96	5057.65	122.00	3.804
92	137.57	4953.18	212.40	4936.10	199.52	5052.14	116.75	3.807
93	138.26	4953.18	210.00	4936.11	199.35	5050.61	115.00	3.807
94	137.57	4953.18	211.20	4936.09	198.94	5050.43	115.00	3.808
95	136.88	4953.18	212.40	4936.10	198.11	5048.44	113.25	3.809
96	138.26	4953.18	212.40	4936.10	200.94	5055.80	120.25	3.809
97	138.94	4953.19	213.60	4936.11	202.51	5059.36	123.75	3.811
98	137.57	4953.18	213.60	4936.11	200.09	5053.84	118.50	3.812
99	140.32	4953.19	210.00	4936.11	201.18	5050.77	115.00	3.812

Critical Failure Surface (circle 1)

Intersects: XL: 141.70 YL: 4953.20 XR: 213.60 YR: 4936.11
Centre: XC: 202.41 YC: 5048.81 Radius: R: 113.25
Generated failure surface: (20 points)
141.70 4953.20 145.08 4951.13 148.54 4949.19 152.05 4947.37
155.63 4945.67
159.27 4944.09 162.96 4942.65 166.69 4941.33 170.48 4940.15
174.30 4939.10
178.15 4938.18 182.03 4937.40 185.94 4936.76 189.87 4936.25
193.82 4935.88
197.77 4935.65 201.73 4935.56 205.69 4935.60 209.65 4935.79
213.60 4936.11

Slice Geometry and Properties - Critical Failure Surface (circle 1, 43 slices)

Slice	X-Left	X-S Area	Base Angle	Width	Length	Matl	Cohesion	Phi	Weight	PoreWater Force	Normal Stress	Test Factor
1	141.70	0.88	31.4	1.69	1.98	2	460.00	32.0	95.92	0.00	-18.19	1.06
2	143.39	2.64	31.4	1.69	1.98	2	460.00	32.0	287.67	0.00	84.54	1.06
3	145.08	4.01	29.4	1.58	1.82	2	460.00	32.0	437.24	0.00	187.10	1.05
4	146.67	6.56	29.4	1.87	2.14	1	0.00	45.0	715.80	0.00	332.22	0.99
5	148.54	7.92	27.4	1.76	1.98	1	0.00	45.0	865.85	0.00	431.22	0.99
6	150.29	9.54	27.4	1.76	1.98	1	0.00	45.0	1043.91	0.00	519.90	0.99
7	152.05	4.67	25.4	0.77	0.85	1	0.00	45.0	511.79	0.00	588.08	0.98
8	152.82	9.25	25.4	1.40	1.55	1	0.00	45.0	1013.68	32.35	641.26	0.98
9	154.23	10.20	25.4	1.40	1.55	1	0.00	45.0	1117.68	97.00	711.65	0.98
10	155.63	11.22	23.4	1.42	1.55	1	0.00	45.0	1230.24	158.22	786.19	0.97
11	157.05	12.10	23.4	1.42	1.55	1	0.00	45.0	1327.10	217.42	851.28	0.97
12	158.47	7.09	23.4	0.80	0.87	1	0.00	45.0	777.58	148.38	888.90	0.97
13	159.27	16.55	21.4	1.84	1.98	1	0.00	45.0	1814.97	403.88	908.58	0.97
14	161.11	16.75	21.4	1.84	1.98	1	0.00	45.0	1836.50	493.19	923.43	0.97
15	162.96	17.10	19.4	1.87	1.98	1	0.00	45.0	1874.95	578.48	940.93	0.97
16	164.83	17.17	19.4	1.87	1.98	1	0.00	45.0	1881.78	659.72	947.91	0.97
17	166.69	17.36	17.4	1.89	1.98	1	0.00	45.0	1903.06	736.94	956.64	0.97
18	168.59	17.29	17.4	1.89	1.98	1	0.00	45.0	1894.87	810.10	955.55	0.97
19	170.48	17.33	15.4	1.91	1.98	1	0.00	45.0	1898.49	879.17	955.48	0.96
20	172.39	17.12	15.4	1.91	1.98	1	0.00	45.0	1874.70	943.99	946.22	0.96
21	174.30	13.33	13.4	1.51	1.55	1	0.00	45.0	1459.61	781.84	939.11	0.97
22	175.80	13.11	13.4	1.51	1.55	1	0.00	45.0	1435.50	816.62	925.45	0.97
23	177.31	7.18	13.4	0.84	0.86	1	0.00	45.0	785.54	467.72	922.98	0.97
24	178.15	16.33	11.4	1.94	1.98	1	0.00	45.0	1787.26	1113.83	937.30	0.97
25	180.09	15.83	11.4	1.94	1.98	1	0.00	45.0	1732.11	1162.12	949.88	0.97
26	182.03	15.36	9.4	1.95	1.98	1	0.00	45.0	1679.91	1206.14	962.08	0.97
27	183.99	14.72	9.3	1.95	1.98	1	0.00	45.0	1608.74	1245.86	967.02	0.97
28	185.94	14.08	7.4	1.96	1.98	1	0.00	45.0	1537.91	1281.50	971.25	0.97
29	187.91	13.29	7.4	1.96	1.98	1	0.00	45.0	1450.87	1312.88	968.44	0.97
30	189.87	9.97	5.4	1.56	1.57	1	0.00	45.0	1088.01	1060.62	965.70	0.98
31	191.44	9.38	5.4	1.56	1.57	1	0.00	45.0	1023.30	1074.97	957.31	0.98
32	193.00	4.67	5.4	0.82	0.82	1	0.00	45.0	508.93	567.17	951.14	0.98
33	193.82	10.57	3.3	1.98	1.98	1	0.00	45.0	1152.60	1381.35	942.70	0.99
34	195.79	9.50	3.3	1.98	1.98	1	0.00	45.0	1035.81	1395.73	925.16	0.99
35	197.77	8.37	1.3	1.98	1.98	1	0.00	45.0	912.54	1405.66	905.58	0.99
36	199.75	7.15	1.3	1.98	1.98	1	0.00	45.0	780.25	1411.46	880.15	0.99
37	201.73	5.87	-0.7	1.98	1.98	1	0.00	45.0	640.45	1412.93	852.19	1.00
38	203.71	4.51	-0.7	1.98	1.98	1	0.00	45.0	492.81	1410.03	818.75	1.00
39	205.69	3.09	-2.7	1.98	1.98	1	0.00	45.0	337.59	1402.95	782.33	1.01
40	207.67	1.60	-2.7	1.98	1.98	1	0.00	45.0	175.33	1391.53	741.01	1.01
41	209.65	0.15	-4.7	0.43	0.43	1	0.00	45.0	16.23	300.34	715.20	1.03
42	210.08	0.38	-4.7	2.16	2.17	1	0.00	45.0	42.11	1502.30	700.48	1.03
43	212.24	0.07	-4.7	1.36	1.36	2	460.00	32.0	7.29	929.14	695.68	1.02
		--------			-------				----------			

X-S Area: 421.26 Path Length: 75.27 X-S Weight: 46094.48